Adaptive Management Plan for WPDES Permit Total Phosphorus Compliance

City of Cedarburg, Wisconsin

Issued September 2021
Symbiont Project No. 21PS37255

Symbiont Project No. 21PS37255

TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

Section 1.0
INTRODUCTION

The City of Cedarburg, Wisconsin, (Cedarburg) has spent the past four years developing a plan to meet Water Quality Based Effluent Limits (WQBELs) for phosphorus in accordance with the mass values from the Total Maximum Daily Load (TMDL) calculation for the Milwaukee River. The planning effort included reviewing how to optimize phosphorus reductions with the current infrastructure, studying options for improving the wastewater treatment process, and estimating watershed reductions that could be used to comply with the permit limits. Cedarburg has elected to implement a watershed management plan commonly referred to as Adaptive Management (AM) to achieve compliance with its Wisconsin Pollution Discharge Elimination System (WPDES) permit.

1.1 BACKGROUND

Cedarburg operates a Water Recycling Center (WRC) in Ozaukee County. Effluent from the WRC is discharged to Cedar Creek in the Milwaukee River (south) watershed of the Milwaukee River basin. The effluent is regulated by WPDES permit No. WI-0020222-09-0.

Cedar Creek is included on the State of Wisconsin's 303d list as impaired for phosphorus. Addendum 1 to the February 1, 2016, water quality memo prepared by the Wisconsin Department of Natural Resources (WDNR) indicates that the Cedar Creek median instream Total Phosphorus (TP) concentration at Covered Bridge Road, north of Cedarburg and upstream of the WRC discharge, was 0.086 mg/L, which is slightly greater than the criterion of 0.075 mg/L in Chapter NR 102.

Cedarburg performed instream sampling at Green Bay Road, downstream of the WRC discharge, throughout 2018, 2019, and 2020. Samples collected during the growing season (May through October) of 2018 had a median of 0.129 mg/L. Samples collected during 2019 and 2020 growing seasons had median values of 0.124 and 0.106 mg/L, respectively. See Table 1-1 below for the data from 2020. This indicates that the Cedar Creek instream TP concentration downstream of the WRC discharge is well above the 0.075 mg/L water quality criterion.

Cedarburg has developed a phosphorus reduction plan that will bring Cedar Creek into compliance with the Chapter NR 102 water quality criterion for phosphorus.

Table 1-1.
2020 Phosphorus Test Results from
Cedar Creek at Green Bay Road

Date	Phosphorus Concentration (mg/L)	Monthly Average (mg/L)	Median (mg/L)
5/5/2020	0.087	0.112	0.106
5/11/2020	0.104		
5/20/2020	0.126		
5/27/2020	0.131		
6/2/2020	0.1	0.137	
6/11/2020	0.151		
6/16/2020	0.124		
6/24/2020	0.139		
6/30/2020	0.171		
7/7/2020	0.164	0.146	
7/15/2020	0.104		
7/21/2020	0.169		
8/5/2020	0.169	0.106	
8/11/2020	0.079		
8/17/2020	0.087		
8/24/2020	0.089		
9/2/2020	0.129	0.1052	
9/9/2020	0.101		
9/16/2020	0.123		
9/22/2020	0.1		
9/29/2020	0.073		
10/5/2020	0.067	0.05075	
10/15/2020	0.029		
10/20/2020	0.028		
10/27/2020	0.079		

1.2 SUMMARY OF WQBEL VALUES

The Milwaukee River TMDL has been approved by the United States Environmental Protection Agency (U.S. EPA), and the mass allocations from the TMDL have been added to Cedarburg's WPDES permit. Monthly mass allocations for point sources are included on Table A.17 on page 70 of Appendix A of the TMDL report. Table 1-2 summarizes the monthly average TP effluent limit in pounds per day, as shown in Cedarburg's WPDES permit.

Table 1-2.
TMDL WQBEL for Phosphorus
from Cedarburg's WPDES Permit

Month	**Monthly Average TP Effluent Limit** (lbs/day)
January	3.71
February	4.19
March	3.88
April	4.25
May	5.14
June	4.50
July	3.88
August	3.32
September	3.67
October	3.46
November	3.73
December	3.54

It should be noted that while the permit lists the average TP discharge in pounds per day by month, the actual TP discharge per day can vary above or below the stated limit as long as the total mass discharged for the month remains below the limit. For example, the January average daily effluent limit is 3.71 lbs/day, and there are 31 days in January, so the monthly limit is 115 lbs. The WRC could discharge 3 lbs/day for 21 days and 5 lbs/day for the remaining 10 days in January and still meet the total monthly limit of 115 lbs.

The month with the most restrictive limit is August, with an average daily limit of 3.32 lbs/day. The months with the least restrictive limits are May and June, with average daily limits of 5.14 and 4.50 lbs/day, respectively.

1.3 SUMMARY OF EFFLUENT PHOSPHORUS

Cedarburg monitors effluent phosphorus concentration and flow in accordance with its WPDES permit requirements. Effluent phosphorus concentration and mass for the existing treatment facility operating under current flows and loading conditions was reviewed throughout the planning period over the last four years. Data compiled from January 2015 through April 2021 indicated the average daily mass of phosphorus in the effluent was 4.77 lb/day with a range from 0.85 to 26.08 lb/day. The following table compares the average value for each month to the TMDL limit.

Table 1-3.
Monthly Average TP Discharged from January 2015 through April 2021
Compared to the TMDL Limit

Month	2015 – 2021 Monthly Average (lb/day)	Monthly Average TP Effluent Limit (lb/day)
January	4.22	3.71
February	4.34	4.19
March	6.04	3.88
April	6.76	4.25
May	7.59	5.14
June	3.67	4.50
July	3.44	3.88
August	3.53	3.32
September	5.14	3.67
October	4.67	3.46
November	3.76	3.73
December	3.97	3.54

Two months currently have average daily values below the TMDL allocation, June and July. Three additional months, February, August, and November are very close. However, several months including March, April, May, and September are significantly above the monthly mass allocation as represented by a daily average.

A cumulative distribution of the effluent TP mass data from January 2015 through April 2021 is shown in Figure 1-1.

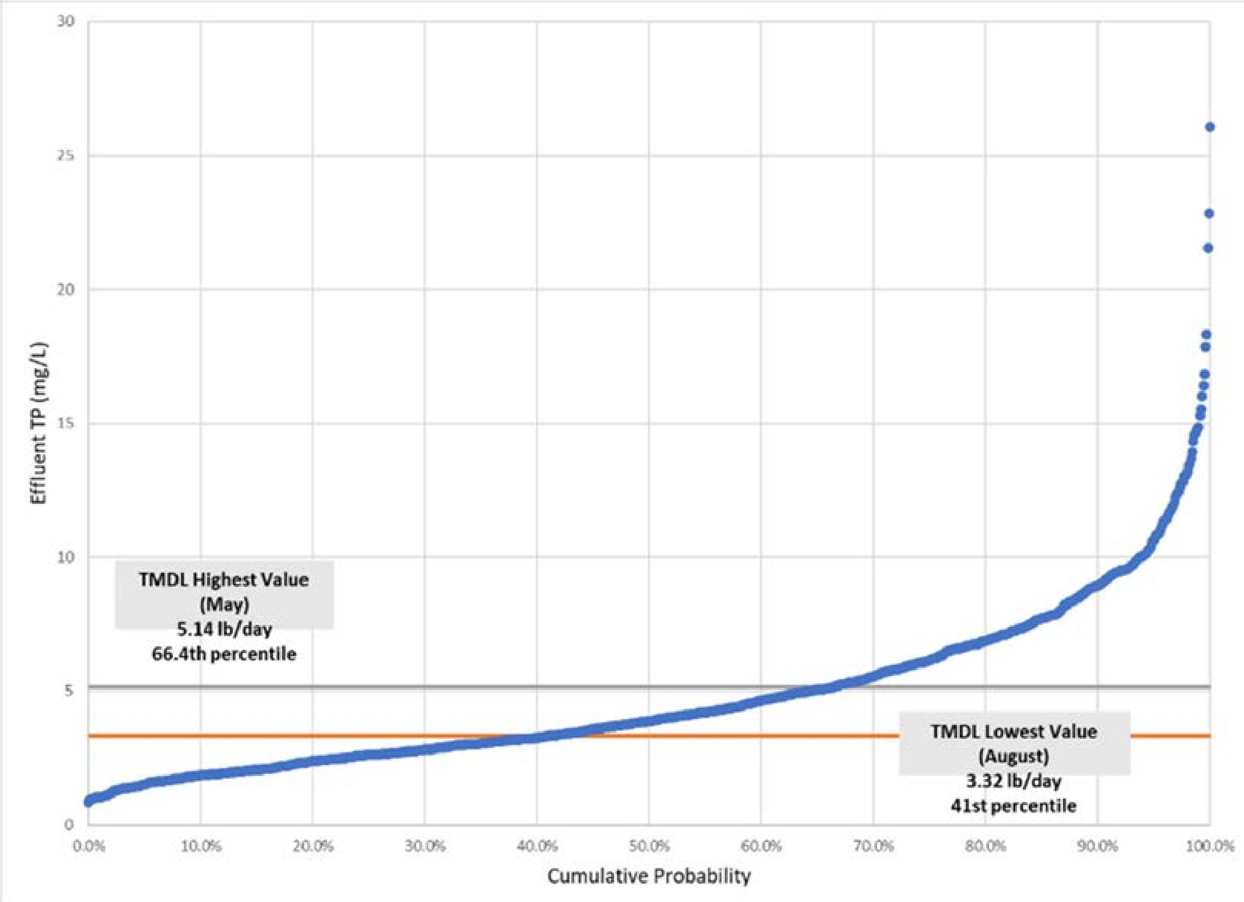


Figure 1-1.
Cumulative Distribution of Total Phosphorous Effluent Mass
January 2015 through April 2021

1.4 SUMMARY OF THE TREATMENT PROCESS

Cedarburg uses physical, biological, and chemical processes to treat its incoming raw wastewater flows at its WRC prior to discharging to Cedar Creek. Figure 1-2 is an aerial view of the WRC. The current average flow rate to the WRC is 1.9 million gallons per day (MGD), and the design flow rate is 2.75 MGD. Three interceptor sewers convey wastewater from Cedarburg's service area to the WRC. The combined flow from the interceptors passes through a headworks building that includes screening and grit removal. Screened and de-gritted sewerage is then pumped to a 3-ring oxidation ditch where it is mixed with return activated sludge. A mass of microorganisms from the returned activated sludge feed on the suspended and dissolved organic wastes contained in the wastewater, aerobically stabilizing the wastewater and aiding in converting ammonia to nitrate. Engineered discs

Figure 1-2.
Aerial View of Cedarburg WRC

located within each ring rotate to provide mixing and oxygen transfer in support of the aerobic microorganisms.

The mixture of wastewater with microorganisms (commonly referred to as mixed liquor) is conveyed to two final clarifiers. Ferric chloride is added to the mixed liquor splitter boxes for phosphorus removal prior to the final clarifiers. The clarifiers allow physical settling and skimming of solids to occur. A portion of the activated sludge microorganisms settling to the bottom of the final clarifiers is then returned to the oxidation ditch to support the treatment process, while the rest is removed from the system.

Wasted solids removed from the treatment processes are collected in a gravity thickener. Thickened solids are transferred to aerobic digesters for solids reduction. Digested sludge is hauled away under a contract with a sludge hauler for disposal.

Final clarifier effluent receives ultraviolet (UV) disinfection and post-aeration from May through September before being discharged to Cedar Creek.

The existing oxidation ditch treatment process was constructed in the mid-1980s. The staff has maintained the existing equipment and replaced components as required. However, some of the large infrastructure items, such as clarifier internals, electrical motor control centers, UV disinfection equipment, disc aerator shafts, and motors, will likely require replacement in the future, as most of this equipment is more than 30 years old.

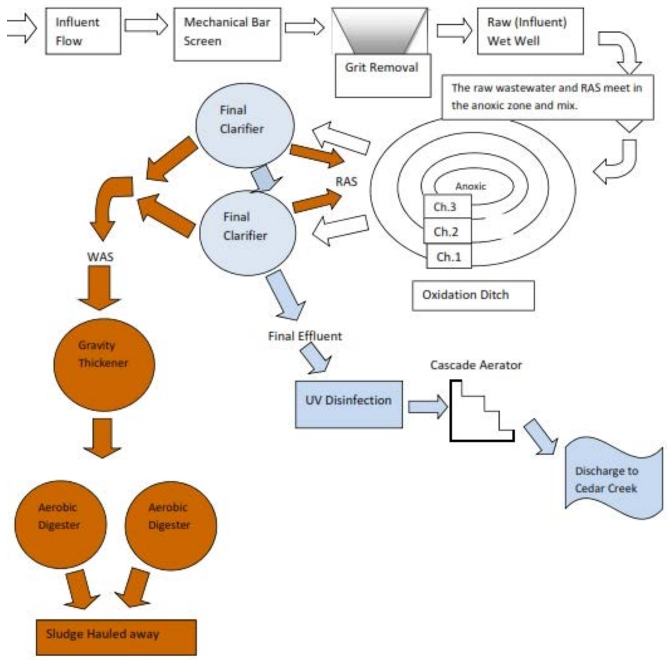


Figure 1-3.
Flow Schematic of Cedarburg WRC

1.5 WWTP PHOSPHORUS OPTIMIZATION

The WRC staff have completed phosphorus optimization activities. Previous studies identified a relatively low influent phosphorus concentration. Decreasing influent phosphorus further would risk nutrient deficient conditions occurring, resulting in a need for WRC staff to add phosphorus to the influent. Given these conditions, the WRC has not pursued any source reduction opportunities at this time but may choose to do so if influent concentrations start to increase.

Cedarburg concludes that the existing WRC infrastructure and operational procedures are optimized for the removal of phosphorus. Any further reductions would include significant costs to implement infrastructure modifications. Cedarburg will soon complete a coagulant modification project to replace the existing bulk storage tank and dosing pumps that are near the end of their useful life. A part of this project involves creating a second addition point of coagulant to help WRC staff refine chemical usage and effluent phosphorus concentration.

1.6 ELIGIBILITY

Cedarburg is eligible to use AM as a compliance alternative because:

1. The instream phosphorus concentration upstream from the discharge outfall was determined to be 0.086 mg/L, which is above the criteria of 0.075 mg/L.
2. The PRESTO™ tool developed by the WDNR indicates that the ratio of point source to non-point source phosphorus load at the WRC discharge location is 14:86, meaning that 14% of the phosphorus load in the reach of Cedar Creek is from point sources including the WRC, and 86% of the load is from non-point sources. This confirms that more than 50% of the total phosphorus load comes from non-point sources.
3. Optimization of the existing WRC will not be enough to achieve the mass allocations from the TMDL for the Milwaukee River. Additional treatment equipment, such as filtration, will be required to reduce the effluent phosphorus concentration to below the WQBEL values from the TMDL.

Section 2.0
NINE KEY PLAN ELEMENTS

In accordance with WDNR guidelines, the AM plan is comprised of nine key elements that are summarized in the following sections. The nine key elements include:

1. Identify Partners
2. Describe Watershed (Action Area) And Load Reduction Goals
3. Inventory Watershed
4. Identify Where Reductions Will Occur
5. Describe Management Measures
6. Estimate Load Reductions During Permit Term
7. Identify How Success Will Be Measured
8. Describe Financial Security
9. Implement Schedule And Milestones

2.1 IDENTIFY PARTNERS

Cedarburg plans to pursue phosphorus reductions opportunities within the action area defined by the Greater Milwaukee River Reach MI-24 to bring this section of Cedar Creek into compliance with the 0.075 mg/L criterion. Cedarburg plans to work with the following area partners:

- WDNR
- Ozaukee County
- Washington County
- Cedar Creek Farmer Group

There are several other organizations or municipalities that are active in this region including the Milwaukee Metropolitan Sewerage District (MMSD), Town of Cedarburg, and Milwaukee Riverkeepers. Cedarburg expects to interact with these groups even though they are not listed as partners.

2.2 DESCRIBE WATERSHED (ACTION AREA) AND LOAD REDUCTION GOALS

The action area for Cedarburg's AM plan is the Greater Milwaukee River Reach MI-24, which includes the WRC outfall. The action area is defined as the portion of Cedar Creek from its confluence with the Milwaukee River on the downstream end and its confluence with an unnamed tributary upstream from HWY M (Country Aire Drive) bridge on the upstream end. The MI-24 reach is shown on Figure 2-1 as the green hashed area. The area boarder by the orange line shows the HUC 12 watershed. Instream sampling has not been completed at the up-creek location of MI-24. It was stated in Section 1.1 that a current estimate for the median TP concentration of Cedar Creek is 0.106 mg/L down creek from the WRC.

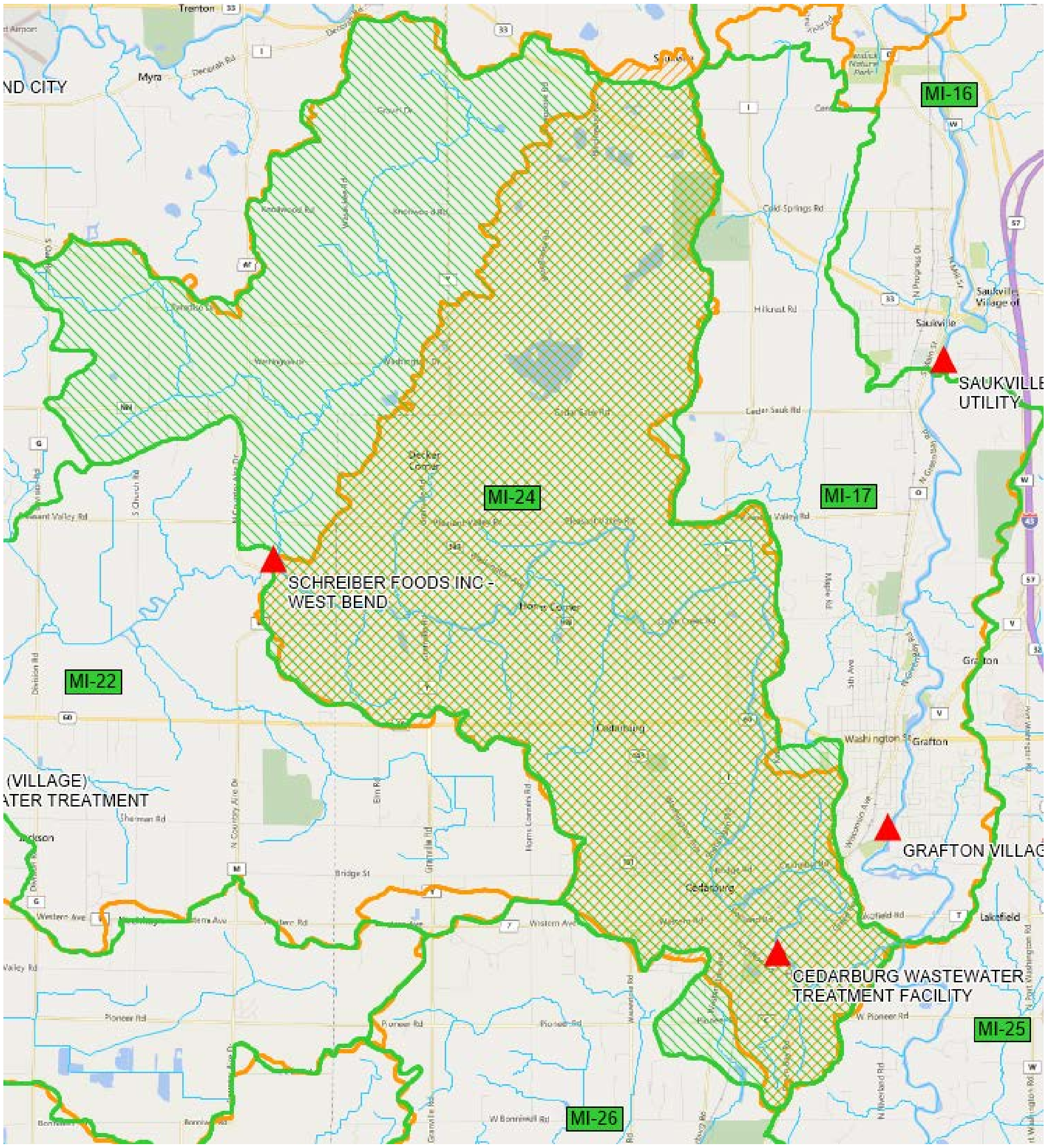


Figure 2-1. Action Area for
Cedarburg Adaptive Management Plan

A mass balance was used to estimate the amount of phosphorus reduction needed for AM. United States Geological Survey (USGS) station 04086500 is located just north of Cedarburg, 6.6 miles upstream from Cedar Creek's confluence with the Milwaukee River. The appendix of this plan contains a summary of the mean annual flow recorded at this station from 1931 through 2020. The mean of these annual flows is 85.5 cubic feet per second (cfs) or approximately 55 MGD. However, the data shows a trend of flow increasing for more recent years. When the statistical analysis of the flow data is limited to the last 30 years, the mean annual flow is 109.1 cfs (70.5 MGD) or approximately 28% higher than the mean of the total flow record period.

Combining the annual mean flow of the total flow data set with an instream TP concentration reduction of 0.031 mg/L (the difference between the current estimated concentration of 0.106 mg/L and the criterion value of 0.075 mg/L) yields an annual reduction target of 5,300 lb/year to bring this reach into compliance with the water quality standard for phosphorus. Using the annual mean flow from the past 30 years, the annual TP reduction target is closer to 6,700 lb/year. The initial basis for this plan will be a target reduction of 5,300 lb but it is noted that the annual load reduction goal could be as much as 6,700 lbs/year.

The phosphorus concentration upstream from the WRC outfall is 0.086 mg/L. If we assume this is the concentration of the creek flowing into the action area, we can estimate that as much as 35% of the phosphorus reduction could be from sources outside the action area. The following calculation shows how this was computed.

Upstream P concentration above the criteria: (0.086 - 0.075) mg/l = 0.011 mg/L

Action area P concentration above the criteria: (0.106 – 0.075) mg/L = 0.031 mg/L

Percentage of P above criteria from outside the action area = 0.011/0.031 x 100 = 35%

Reducing nonpoint sources of phosphorus from areas outside the action area will contribute to reducing the instream phosphorus concentration within the action area. This plan includes potential P reductions from TMDL reach MI-22 which is immediately up creek from the action area.

2.3 INVENTORY WATERSHED

This section summarizes the potential opportunities for P reductions based on land use within the action area and the region up creek from the action area. The main source for the land use is the Watershed Restoration Plan for Cedar Creek prepared by Southeastern Wisconsin Watersheds Trust, Inc (Sweet Water) dated On June 29, 2020. This plan was funded through grants from the WDNR and MMSD and was approved by the WDNR.

The action area includes HUC 12 040400030303 and 040400030304. The majority of the action area covers 04040003034. The Sweet Water restoration plan describes this HUC 12 as having 18,151 acres of area with approximately 18 stream miles of Cedar Creek. It is estimated that 4,253 acres are cropland; 450 acres are pastureland, and 3,006 acres are grassland. This information along with other information contained in the Watershed Restoration Plan will help define the baseline loads from various sources within and upstream from the action area.

Table 2-1 summarizes the estimated acreage of cropland and annual baseline phosphorus loads as reported by Sweet Water.

Table 2-1.
Farmland Inventory as Reported by Sweet Water

Type of Ag Operation	**Acres of Cropland** (acres)	**Baseline P** (lb/year)
MI-22 Cropland	11,344	28,818
MI-24 Cropland	4,253	12,551
Total	**15,597**	**41,369**

Cropland in MI-22 and MI-24 covers 38% and 23% of the land, respectively. It is worth noting that the total baseline phosphorus values are significantly higher than the baseline values in the

TMDL, which estimated the phosphorus load from all sources within MI-22 and MI-24 (MS4s, non-point sources and point sources) exceeding 13,300 lb/yr. The differences in estimated baseline loadings are likely impacted by differences in the modeling approaches, assumptions, and inputs.

Cedarburg’s proportional share of the in-creek phosphorus mass is calculated by comparing the current average WRC phosphorus discharge to the current in creek phosphorus mass using the median concentration from Section 1.1. This calculation is shown in Table 2-2.

Table 2-2.
Cedarburg WRC TP Discharge Compared to Cedar Creek TP

Phosphorus Source	Mass Calculation	Annual Mass (lbs)
The Cedarburg WRC	Average daily discharge: 4.77 lb Annual discharge: 4.77 x 365 days = 1,741 lb	1,741
Cedar Creek (Greater Milwaukee River Reach MI-24)	Average flow: 55 MGD Median concentration: 0.106 mg/L Average daily mass: 8.34*0.106*55 = 48.6 lb Annual TP mass: 48.6 x 365 = 17,740 lb	17,740

The City’s proportional share within Cedar Creek is computed as follows:

$$\text{City of Cedarburg Share} = \frac{1{,}741\ lb\ from\ the\ WWTP}{17{,}740\ lb\ TP\ mass\ in\ Cedar\ Creek}\ x\ 100 = 9.8\%$$

The 5,300 lb/yr reduction needed to bring the river into compliance with the WQBEL criteria is about 13% of the baseline phosphorus loading provided by Sweet Water. However, this value may change as SNAP Plus modeling is used to estimate load reductions in place of STEPL. To help with estimating the potential load reductions from implementing and maintaining best management practices in the watershed, a SNAP Plus analysis was performed for two cropland fields located within MI-24 using soil data and crop rotations. The first example involves land purchased by Cedarburg, shown in Figures 2-2 and 2-3. This example was included in Cedarburg’s final alternatives plan. Approximately 72.3 acres of this land has been used to grow crops over the past many years.

Figures 2-2 and 2-3. Farm Fields Owned by Cedarburg

For the purpose of developing SNAP Plus models, the fields were divided into four quadrants labeled SB1, SB2, SB3, and SB4. Figure 2-2 shows the acreage of each quadrant. The green line on Figure 2-3 illustrates the HUC 12 dividing line. In this area, the HUC 12 dividing line matches the action area (MI-24 TMDL region) dividing line. Only 25.7 acres reside within Cedarburg's action area. The 25.7 acres is comprised of approximately 87.5% of SB1 (21 acres), about 33% of SB-3 (4.2 acres), and 6.7% of SB2 (0.5 acres). SB4 lies outside the action area watershed.

SNAP Plus modeling was performed for these fields, based on typical soil types for this region and crop rotations for a preliminary evaluation. More accurate data will be collected should Cedarburg decide to proceed with the installation of best management practices. The SNAP Plus modeling is based on the conversion of the 25.7 acres to a prairie occurring in 2021. Information on the modeling can be found in the appendix based on an assumed a typical crop rotation of corn grain, soybeans, hay, and alfalfa alternating through the quadrants. Combining the difference for SB1, SB2, and SB3 for each year with the acres of land within the action area for the respective field will yield the annual TP reduction potential.

Table 2-3.
Potential Annual TP Reductions (lb/yr)

Year	SB1	SB2	SB3	Total
2022	107.1	2.0	26.9	136
2023	128.1	1.8	16.4	146.3
2024	58.8	0.9	12.6	72.3
2025	79.8	1.2	8.4	89.4

If the conversion to prairie occurred in 2021, the estimated TP reduction potential would range from 72.3 to 146.3 lb TP per year for an average of 111 lb P per year starting in 2022. This reduction represents just over 2% of the total target reduction for the AM plan.

The second example involves land located north of Cedarburg. The Figure 2-4 shows the fields. These fields are located along either side of Cedar Creek. The field designated as CC East covers approximately 12.8 acres, and the field designated as CC West covers 23.2 acres. These fields currently are under a crop rotation of corn, soybeans, and winter wheat. Baseline SNAP Plus modeling estimated the phosphorus released from CC East ranges from 0.8 to 3.6 lb/ac-yr and from CC West from 0.8 to 2.7 lb/ac-yr.

If cover crop and no-till practices were started in 2022, the estimates from SNAP Plus modeling for the TP reduction range from 20 to 43 lb/yr for all 36 acres of CC East and CC West, with an average of 37.4 lb TP per year. This represents about 0.75% of the total target reduction for the AM plan. See Table 2-5 for annual estimates of the TP reductions for each field.

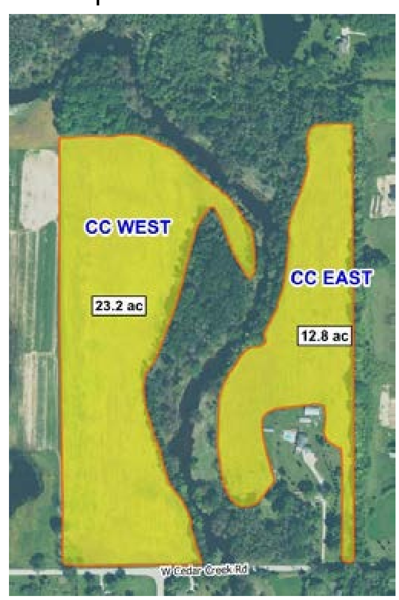


Figure 2-4. Farm Fields North of Cedarburg

Table 2-4.
Potential Annual Phosphorus Reductions for Each Field (lb/yr)

Year	CC East	CC West	Total
2022	28.2	20.8	49
2023	28.2	41.7	69.9
2024	2.6	7.0	9.6
2025	2.6	16.2	18.8
2026	6.4	39.4	45.8
		Average	38.6

These two examples involve just under 62 acres of farmland yielding an annual average of just under 150 lb of phosphorus reduction per year.

In addition to the agricultural sources, the Sweet Water report identifies 3,542 lb/yr of phosphorus coming from urban sources. Within HUC 12 040400030304, the most significant urban source is Cedarburg as most of the city is contained within this HUC 12 region.

2.4 IDENTIFY WHERE REDUCTIONS WILL OCCUR

The adaptive management plan focuses on targeting phosphorus reductions throughout the action area and upstream from the action area including:

- Improvements to agricultural operations (within the Greater Milwaukee River Reaches MI-22 & MI-24)
- MS4 reductions within the City of Cedarburg

The reductions necessary to reduce the in-creek phosphorus concentration to the criterion of 0.075 mg/L would involve the following two opportunities for reductions.

Opportunity 1 – **Agricultural Improvements Within Reaches MI-22 and MI-24**

Cedarburg will support implementation of best management practices and other improvements to agricultural operations within the MI-24 reach and up creek within the MI-22 reach. As reported by Sweet Water, the preliminary analysis suggests that baseline phosphorus runoff from over 15,500 acres of agricultural lands in the targeted areas of MI-22 and MI-24 far exceeds the targeted reduction of 5,300 lb/yr. Cedarburg, working together with regional partners Ozaukee County and Cedar Creek Farmers Group, will assist farmers with implementing and maintaining best management practices that support phosphorus reductions to the watershed. Sweet Water offers a vision within the watershed restoration plan for potential best management practices (BMPs) that could be implemented. The Sweet Water plan yields an estimated 1,521 lb reduction over a 10-year period through nutrient management plans, reduced tillage, cover crops, grassed waterways, or some combination.

Cedarburg, after meeting with members of the Cedar Creek Farmers group, plans to be more aggressive with implementation. The two examples presented in the proceeding section demonstrate that greater reductions are possible. The Appendix of this plan includes letters of support from both the County and the Cedar Creek Farmers Group.

Opportunity 2 – MS4 Reductions throughout Cedarburg

Additional P reductions are possible from within the City of Cedarburg contributing to the over 3,500 lb/year of P into the watershed from urban sources. Cedarburg will invest resources to target TSS and phosphorus reductions throughout the city from wet weather sources. Cedarburg will likely consider two approaches for addressing MS4 improvements. The first approach is based on capturing and infiltrating wet weather flows using green infrastructure to prevent flow from reaching the creek. The second approach will use treatment technologies to reduce the phosphorus concentration in the wet weather flow before it reaches the creek. Computer modeling tools will be used for each practice being considered to estimate the potential load reductions helping to contribute toward the 5,300 lb annual target.

Target Reductions

This plan targets phosphorus reductions within the action area and in areas up creek. Most of these reductions are expected to come from agricultural sources. A smaller amount will likely come from MS4 related projects. The total phosphorus target of 5,300 lb/year goes well beyond the minimum load reduction necessary based on Cedarburg's proportional share. As shown in Section 2.3, Cedarburg's proportional share of TP in the river is 9.8%. The minimum necessary to be eligible to continue the AM plan into the second permit term is 9.8% of 5,300 lb or 514 lb. Cedarburg has every expectation of surpassing this minimum requirement.

Cedarburg recognizes that the target reduction for achieving water quality could be even higher than 5,300 lbs as more data is collected through creek monitoring. Cedarburg will review the creek monitoring data, consult with partners to identify areas for reductions, develop projects that achieve reductions, implement projects, and monitor the results. This iterative approach to achieving compliance will allow Cedarburg to adjust as needed.

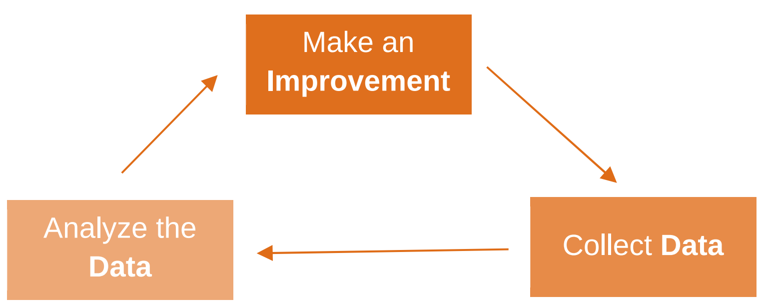


Figure 2-5. Schematic of Iterative Compliance Approach

If the data indicates that the water quality criterion has been achieved, new watershed improvement work will be suspended, and Cedarburg will continue to collect more data.

2.5 DESCRIBE MANAGEMENT MEASURES

The initial discussions that have taken place with Ozaukee County, Washington County and Cedar Creek Farmers Group have focused on cover crop, harvestable buffers, and no-till farming practices. Some farmers in the region have experience with these soil health land management practices, making it easier to get other farmers in the region to implement.

Other practices that maybe promoted include:

- Change in direction of tillage
- Addition of in field designed filter strips
- Addition of edge of field designed filter strips
- Reduction in fertilizer or manure application rates
- Conservation crop rotation use
- Change in timing of tillage (e.g., fall to spring)
- Change in the timing of manure applications

In addition, Cedarburg may also consider removing farmland from operation converting it to natural prairies such as on the farmland owned by Cedarburg.

2.6 ESTIMATE LOAD REDUCTIONS DURING PERMIT TERM

Cedarburg has the goal of lowering the median phosphorus concentration in the creek to below the WQBEL criterion by the end of the first 5-year permit term. It is estimated that a 5,300 lb reduction is needed. The following preliminary schedule outlines the annual goals for Cedarburg.

Table 2-5.
Tentative Project Schedule

Year	Activities	Projected Annual Phosphorus Reduction (lb/yr)	Accumulated Total Annual Phosphorus Reduction (lb/yr)
1	Action area sampling in the Greater Milwaukee River non-point Area within reaches MI-24.	0	0
2	Action area sampling, improvements in the Greater Milwaukee River non-point area within reaches MI-24.	500	500
3	Action area sampling and improvements in the Greater Milwaukee River non-point area within reaches MI-22 and MI-24	1,600	2,100
4	Action area sampling and improvements in the Greater Milwaukee River non-point area within reaches MI-22 and MI-24	1,600	3,700
5	Action area sampling and improvements in the Greater Milwaukee River non-point area within reaches MI-22 and MI-24	1,600	5,300

By the end of this 5-year project schedule, Cedarburg hopes to be responsible for phosphorus reductions within the Greater Milwaukee River reaches MI-22 and MI-24 of 5,300 lb per year.

Cedarburg plans to revise this project schedule based on the results from the monitoring program. Some examples of adjustments include:

- Data showing that projects in the Greater Milwaukee River reaches MI-22 and MI-24 are not achieving the phosphorus reductions could result in increasing agricultural improvements or MS4 projects.
- Data showing that Cedar Creek is in compliance with water quality criterion at the pour point could result in suspending the project schedule and continuing to monitor the creek.

2.7 IDENTIFY HOW SUCCESS WILL BE MEASURED

The goal is to lower the in-creek phosphorus concentration to meet the applicable water quality criterion at the pour point defined as the down-river monitoring location (designated as sample location 5 in the QAPP). Success will be determined when the annual growing season median phosphorus concentration is at or below the water quality criterion. The water quality criterion is:

- State of Wisconsin standard value of 0.075 mg/L for this section of Cedar Creek, or
- State of Wisconsin and U.S. EPA approved site-specific criterion based on biological metrics in accordance with new rule making being promoted by the Department, or
- Any change to State of Wisconsin standard value for this section of Cedar Creek

Interim successes will be measured under the following:

- Phosphorus concentration decreases throughout the action area, but perhaps not all the way to the water quality criterion.
- Improved biological metrics or water clarity measurements support improving aquatic habitat.
- Improved soil health resulting from improvements to agricultural operations. Improved soil health has been linked to water quality improvements.
- SNAP Plus modeling results demonstrating that implemented agricultural best management practices contribute to reducing phosphorus runoff.
- Wet weather modeling results demonstrating that implemented MS4 related projects contribute to reducing phosphorus runoff.

Annual reports will summarize all activities that have occurred over the preceding year along with identifying interim successes, SNAP Plus modeling evaluations, and any quantitative measurements of water quality improvements.

If Cedarburg collects data that shows the median phosphorus concentration is at or below the criterion, Cedarburg intends to suspend all future project work but complete and support work that is already in progress. Monitoring will continue to confirm that the water quality criterion is being met. Cedarburg will resume project work should subsequent monitoring results show that the criterion is being exceeded. Cedarburg will assume two years of achieving the water quality criterion will be evidence that the creek is meeting water quality and Cedarburg's adaptive management plan is successful.

2.8 DESCRIBE FINANCIAL SECURITY

Cedarburg prepared financial estimates for the cost of AM as part of the Final Compliance Alternatives Plan assuming 5, 10, and 15 years to achieve the water quality TP goal. Table 2-7 represents the present value of the costs as found in the final plan.

Table 2-6.
Preliminary Alternatives Present Value Summary as Provided in the Final Compliance Alternative Plan

Capital Cost	Tertiary Treatment	Adaptive Management		
		Compliance in 5 Years	Compliance in 10 Years	Compliance in 15 Years
Initial Capital Cost	$3,200,000	$0	$0	$0
Additional Costs Over 20 Years	$250,000	$215,000	$215,000	$215,000
Operating Costs - Sum of Operating Costs Over 20 Years at 3% Inflation	$3,832,300	$4,175,300	$5,324,300	$6,723,309
Total Present Value of 20 Years of Costs at 4%	**$6,960,000**	**$1,650,000**	**$3,500,000**	**$5,550,000**

Cedarburg estimated that the average annual cost of adaptive management in the first 5 years could be $215,000. Cedarburg has budgeted funds for AM in fiscal year 2022 as follows:

1. $100,000 to cover administrative costs for hiring a third party to run the AM program
2. $100,000 to cover costs for initiating agricultural support and other associated costs

It is anticipated that future annual budgets would increase to account for the missing $15,000 from the 2022 budget.

2.9 IMPLEMENT SCHEDULE AND MILESTONES

Cedarburg is prepared to implement this adaptive management plan beginning in 2022, with the goal of bringing the action area of Cedar Creek into compliance with phosphorus water quality standards by 2027. Table 2-8 shows a sample schedule for achieving compliance.

Table 2-7.
Sample of the Initial Implementation Schedule

Date	Activities	Notes
April 1, 2022	New WPDES permit is issued based on AM plan.	
May 1, 2022	Begin monitoring of Cedar Creek throughout action area.	This activity will be performed by the City in accordance with the Quality Assurance Project Plan included in the Appendix of the AM plan. This activity will continue through October.

Date	Activities	Notes
November 1, 2022	Suspend monitoring of Cedar Creek as the growing season period ends.	
Fall 2022	Provide support to agricultural operations for installation of BMPs such as cover crop, harvestable buffers, and to practice no-till.	
February 1, 2023	Submit annual report for 2022.	This report will summarize the results of the first-year monitoring along with any BMP installation within the Greater Milwaukee River reach MI-24. The report will identify projects to be implemented in 2023.
May 1, 2023	Resume monitoring of the Cedar Creek throughout action area.	
Summer 2023	Review data collected and revise agricultural support as necessary	
November 1, 2023	Suspend monitoring of Cedar Creek as the growing season period ends.	
Fall 2023	Provide support to agricultural operations for expansion of BMPs such as cover crop, harvestable buffers, and to practice no-till.	
February 1, 2024	Submit annual report for 2023.	

This sample schedule covers the first 2 years of the initial 5-year plan. The annual report will include a schedule for the following year until the end of the 5-year permit term.

APPENDIX A

Quality Assurance Project Plan (QAPP)

Quality Assurance & Quality Control Project Plan for Adaptive Management River Monitor Program of Total Phosphorus

City of Cedarburg, Wisconsin

Issued September 2021
Symbiont Project No. 21PS37255

Symbiont Project No. 21PS37255

TABLE OF CONTENTS

APPENDIX A – FIGURES

APPENDIX B – TABLES

APPENDIX C – MISCELLANEOUS

PROJECT MANAGEMENT

This document has been prepared according to the United States Environmental Protection Agency (U.S. EPA) publication *EPA Requirements for Quality Assurance Project Plans* dated March 2001 (QA/R-5).

1.1 PROJECT/TASK ORGANIZATION

The City of Cedarburg, Wisconsin, (Cedarburg) is implementing a program to monitor water quality in Cedar Creek upstream and downstream of Cedarburg's Water Recycling Center (WRC) as part of Cedarburg's Adaptive Management (AM) plan to lower the phosphorus concentration within this section of Cedar Creek to meet water quality standards. The monitoring program will be conducted during the growing season on a yearly basis until such time as water quality is achieved for a 2-year period. Organizing and implementing the monitoring program is a joint effort between Cedarburg and its AM plan administrator.

Cedarburg will be responsible for performing the following activities to collect samples and analyze phosphorus concentrations at five locations in Cedar Creek:

- Obtain sample bottles before each sample event and arrange for delivery of the samples to Cedarburg's WRC laboratory for analysis in accordance with the approved Quality Assurance Project Plan (QAPP).
- Collect the required surface water samples as described in Section 2.0.
- Transport the samples under proper chain-of-custody to the WRC laboratory for analysis.
- Analyze the samples for the parameters described in Section 1.3 following the procedures included in Appendix C.
- Record in a Microsoft Excel spreadsheet or equivalent the data collected during each sampling event.

The AM plan administrator will be responsible for the following activities:

- Prepare a QAPP for water quality monitoring program.
- Analyze the resultant data and provide Cedarburg with an annual letter report that describes the results of the monitoring program.

Cedarburg will provide a sampling team consisting of field technicians who will collect the required samples. Field technicians will be responsible for equipment preparation, sample collection, field measurements, and sample transportation.

All Cedarburg WRC laboratory personnel shall be responsible for the laboratory analysis and the maintenance of their internal Quality Assurance/Quality Control (QA/QC) procedures (Appendix C).

1.2 PROBLEM DEFINITION/BACKGROUND

Cedarburg owns a WRC that discharges to Cedar Creek. Discharges from the plant must comply with a Wisconsin Pollution Discharge Elimination System (WPDES) permit. The permit requires Cedarburg to reduce phosphorus discharges to the Milwaukee River to meet water quality regulations. Cedarburg elected to implement an AM plan to restore in-creek total phosphorus (TP) concentrations to water quality standards at the most down-creek location of the AM planning action area, which is Milwaukee River TMDL reach MI-24 shown on Figure 3 in Appendix A.

The monitoring program will benchmark TP concentrations throughout the action area. This monitoring program will help establish current phosphorus concentration in the creek and quantify reductions achieved by various phosphorus runoff reducing practices.

1.3 PROJECT/TASK DESCRIPTION

A map showing the proposed monitoring locations is included as Figure 2 in Appendix A. Section 2 further identifies each sample location site. All sample locations will be georeferenced using GPS technology.

The parameters listed below will be analyzed monthly during the growing season at normal flow conditions as defined by the United States Geological Survey (USGS) at flow monitoring station 04086600.

- Total Suspended Solids (TSS)
- Total Phosphorus (TP)
- Filtered Phosphorus (Orthophosphate)

Sample collection and analysis will begin the process of building a data set that will quantify the impact phosphorus reduction practices have on in-river TP concentrations.

1.4 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements, which specify the quality of the data required to support decisions made during the project and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels, which address various data uses and the QA/QC effort and methods required to achieve the desired level of quality. These levels are described below.

Screening (DQO Level 1): This level provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at the site, initial site characterization to locate areas for subsequent and more accurate analyses, and engineering screening of alternatives. These types of data include those generated on site through the use of pH, Dissolved Oxygen (DO), Oxidation Reduction Potential (ORP), temperature, and specific conductance probes, as well as other real-time monitoring equipment at the site.

Field Analysis (DQO Level 2): This level provides rapid results and better quality than in DQO Level 1. This level may include mobile laboratory generated data depending on the level of quality control exercised.

Engineering (DQO Level 3): This level provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile laboratory generated data and some analytical laboratory methods (e.g., laboratory data with quick turnaround used for screening but without full quality control documentation).

Confirmational (DQO Level 4): This level provides the highest level of data quality and is used for purposes of risk assessment and evaluation of remedial alternatives.

Non-Standard (DQO Level 5): This level refers to analyses by non-standard protocols, for example, when exacting detection limits or analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

The analytical data generated by the phosphorus monitoring activities for Cedar Creek will be DQO Level 4.

1.5 QA/QC OBJECTIVES FOR MEASUREMENT DATA

The overall QA/QC objectives of this project are to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, and reporting that will provide results that are legally defensible in a court of law. The purpose of this section is to address the specific objectives for completeness, representativeness, and comparability.

1.5.1 Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total data obtained over the course of the project. Site access, sampling protocol problems, analytical problems, and the data validation process can all contribute to missing or suspect data. It is expected that the data will meet QA/QC acceptance criteria for 95% or more for all samples tested. If the completeness objective is not met, actions will be taken to improve performance. This may take the form of an audit to evaluate the methodology and procedures used as possible sources for the difficulty and/or may result in the recommendation of a different method.

1.5.2 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter, which is dependent upon the proper design of the sampling program and proper laboratory protocol. The sampling network was designed to provide data representative of site conditions. The rationale for the sampling locations is discussed in Section 2.1.1 and Table 2 of Appendix B. Representativeness will be satisfied by ensuring that the proper sampling techniques are used, proper analytical procedures are followed, and holding times of the samples are not exceeded in the laboratory. Representativeness will be assessed by the analysis of field duplicated samples.

1.5.3 Comparability

Comparability expresses the confidence with which one set of data can be compared with another. Comparability can be related to precision and accuracy, as these quantities are measures of data reliability.

Quantitatively, data subjected to strict QA/QC procedures will be deemed more reliable than other data. Field data will be obtained following a given procedure and will be reported in consistent units to allow for easy comparisons.

1.6 DOCUMENTS AND RECORDS

Sampling collection records, field notebooks, and all records of field activities shall be retained by Cedarburg for 5 years. Sample collection records shall document proper sampling protocol performed in the field. In addition, the Project Managers, defined in Table 1 of Appendix B, shall retain all laboratory analytical results and all laboratory correspondence associated with the project. Chain-of-custody forms submitted to the laboratory shall also be retained along with the analytical results. Cedarburg's Project Manager and the Symbiont Project Manager, defined in Table 1 of Appendix B, shall be made aware of any problems encountered during any phase of the project.

Cedarburg shall retain copies of all management reports and memos.

Section 2.0
DATA GENERATION AND ACQUISITION

2.1 SAMPLING PROCESS DESIGN

The following section discusses the sampling process design.

2.1.1 Site Identification and Sampling Rationale

Data sampling stations are shown in Figure 2 in Appendix A. Sample location sites are described and criteria for selection are as follows:

Site 1:	The confluence of the unnamed creek and Cedar Creek near Pleasant Valley Road helps document phosphorus reductions from the northwest region of the action area.
Site 2:	Cedar Creek just upstream of the Schreiber Foods outfall and the confluence with the unnamed creek helps determines the TP concentration of Cedar Creek flowing into the action area.
Site 3:	Cedar Creek, upstream of the WRC outfall at Lakefield Road continues sample collection started by Cedarburg and may offer insight regarding phosphorus reductions from agricultural regions of the action area.
Site 4:	Cedar Creek, downstream from the WRC at Green Bay Road, continues sample collection started by Cedarburg and may offer insight regarding phosphorus reductions from MS4 sources within Cedarburg.
Site 5:	Cedar Creek at the confluence with the Milwaukee River. This location is the “pour point” for the action area. This is the critical sample location for compliance.

Additional sampling stations may be added or removed based on data evaluation by the AM plan administrator.

2.1.2 Sampling Frequency

Samples will be collected monthly during the growing season and under normal flow conditions as determined by USGS. The growing season is defined as May through October. USGS defines normal flow conditions as flow between the 25 and 75 percentiles of flow over the last 30 years or more. USGS Station 04086500 will be used to monitor flow. This station has over 85 years of flow records.

Samples will only be collected when conditions are safe. Sample collection will be postponed when unsafe conditions exist, such as high flow or storms. Cedarburg plans to collect one or more samples during each month of the growing season. Data from samples collected within a 30-day period within a calendar month will be averaged to obtain a single representative value for the month. A total of six representative data points, one for each month of the growing season, will be reported by the Cedarburg, along with the median value of the six data points. The median value will be used to determine compliance of the creek with the water quality standards. All data will be included in the annual report that will be provided to the Wisconsin Department of Natural Resources (WDNR).

2.2 SAMPLING METHODS

Surface water grab samples will be collected at the locations specified in Section 2.1.1. Water quality samples will be collected from each location using the direct method or the Kemmerer bottle method. Sample bottles will be filled, labeled and packed on ice. A clean pair of latex gloves will be worn for each water quality sample collected by the sampling team. All samples will be delivered to and/or picked up by the laboratory with sufficient time to meet holding times.

2.3 SAMPLE HANDLING AND CUSTODY

The collected samples will be labeled appropriately, custody seals applied, placed in coolers, and stored on ice at approximately 4°C immediately after collection and kept on ice during transport to or pick up by the laboratory within the prescribed holding times. The lead technician for each sampling team will be responsible for contacting the laboratory and coordinating sample delivery. Samples will be delivered to or released to a representative of the laboratory defined under the chain-of-custody procedures within 24 hours of collection. Preservatives, if necessary, will be provided in the containers provided by the laboratory. Table 3 describes field collection containers, preservation and holding times.

The laboratory will record temperature upon arrival at the laboratory. Samples that require thermal preservation will be refrigerated after sample acceptance at the laboratory.

When received by the laboratory, the samples will be logged into the laboratory logbook and/or laboratory database. Maximum holding times before analysis, as stated in applicable laboratory method standard operating procedures (SOPs), provided in Appendix C, will be followed.

2.4 ANALYTICAL METHODS

All methods used by the laboratory for data analysis will be U.S. EPA-approved methods listed in 40 CFR Part 136. Table 3 describes holding times as established in 40 CFR Part 136 and the detection limits of Cedarburg's WRC laboratory to be used in this study.

2.5 LEVEL OF QUALITY CONTROL EFFORT

QA/QC procedures are necessary both in the field and in the laboratory to ensure that the data collected in environmental monitoring programs are of known quality, useful and reliable. QA/QC procedures can be divided into two categories: field QA/QC procedures and laboratory QA/QC procedures.

2.5.1 Field Quality Control

All field personnel will be responsible for ensuring that proper sampling methods, sample preservation, and sample custody of the delivered samples to the designated laboratory are followed. Refer to Appendix C for additional sample collection and field procedures. A sample data sheet is also included in Appendix C.

Duplicate samples are typically collected and analyzed to assess the quality of data resulting from a monitoring program. Duplicate samples are analyzed to check for sampling and analytical reproducibility. The scope of QA/QC samples is dependent on project objectives. The general level of the QA/QC effort for this monitoring program will be one field duplicate for every ten or fewer monitoring samples.

In the event of a QA/QC or noncompliance issue, an investigation and corrective action report will be prepared by Cedarburg's Project Manager. The Project Manager will then forward this report to the project's QA/QC officer. The accuracy and precision of all data measurements must be quantifiable. Analytical procedures used for data analysis must be performed according to approved standard methods. Data measurements should be recorded in a controlled environment in which a quality control program can be maintained.

2.5.2 Laboratory Quality Control

Laboratory QA/QC procedures ensure analyses of known and documented quality through instrument calibration and the processing of samples. Precision of laboratory findings refers to the reproducibility of results. In a laboratory QA/QC program, a sample is independently analyzed more than once, using the same methods and set of conditions. The precision is estimated by the variability between repeated measurements. Accuracy refers to the degree of difference between observed values and known or true values. The accuracy of a method may be determined by analyzing samples to which known amounts of reference standards have been added.

The laboratory is responsible for the accuracy and reliability of analytical methods and final data reports according to their QA/QC manual. The Project Manager will work closely with the Laboratory Project Manager to implement QA/QC procedures in accordance with the QAPP from in Appendix C.

A failure of an internal QA/QC limit will result in an investigation and a corrective action report by the Laboratory Project Manager. A copy of the corrective action report will be submitted to the Project Manager(s) and will be filed by date. Samples that have failed any QA/QC limit will be retested, if possible. The laboratory will maintain the QA/QC records for the analytical runs for the samples of interest.

2.6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION AND MAINTENANCE

All laboratory equipment will be routinely maintained according to the manufacturer's manuals. Any equipment used for field data measurements will be tested, calibrated, and inspected prior to sampling events and after the equipment returns from the field.

2.7 INSTRUMENT CALIBRATION AND FREQUENCY

Instruments used in the laboratory will be calibrated prior to use according to the manufacturer's manual. The laboratory shall calibrate instruments according to internal QA/QC manual and SOPs. The laboratory shall also keep adequate records of equipment calibration and to U.S. National Institute of Standards and Technology (NIST) traceable standards when possible.

2.8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Supplies and consumables used in the field shall be inspected by the field teams to guarantee their usability. Supplies and consumables used in laboratory procedures shall be inspected by laboratory managers to confirm compliance with laboratory QA/QC manuals and SOPs.

2.9 NONDIRECT MEASUREMENTS

Nondirect measurements will not be obtained for the project.

2.10 DATA MANAGEMENT

Field books, field measurement records, and other data gathered in the field shall be maintained for five years in project files by the Project Managers. The laboratory will convey all laboratory analytical data to the Project Managers in the laboratory's standard report form.

Section 3.0
ASSESSMENT AND OVERSIGHT

3.1 ASSESSMENT AND RESPONSE ACTIONS

Performance evaluations of the sampling teams will be conducted by Cedarburg's Project Manager. The sampling team will be evaluated to determine if sampling protocol is followed, and evaluations will be documented by the Project Manager. QA/QC and noncompliance issues related to field activities will require an investigation and corrective action plan by the Project Manager.

The WRC laboratory performing data analysis shall maintain internal quality assurance programs as described in their QA/QC plans. Most laboratories maintain QA/QC checks for procedures. When the possibility of QA/QC problems or noncompliance issues arise that may affect the usability of data, an investigation and corrective action report will be submitted by the Project Manager.

In addition, the Project Manager shall make certain that the project data associated with any quality control or other nonconformance issue is made available to data users with the appropriate data qualification. When data previously released to data users may have been affected by a quality control problem or other nonconformance issue, the Project Manager shall notify other data users of the problem.

3.2 REPORTS TO MANAGEMENT

The Project Manager will receive investigation and corrective action reports in case of any QA/QC or noncompliance issue. Any QA/QC problems affecting the final reported values shall be reported to all data users.

Section 4.0
DATA VALIDATION AND USABILITY

4.1 DATA REVIEW, VALIDATION, AND VERIFICATION REQUIREMENTS

The Project Managers will review final analytical data reports and address any issue related to data reliability as mentioned in pertinent investigation and corrective action plans. Qualified laboratory data will be listed as such in any reports or data submitted. The QA/QC objectives including methods of analysis, matrix precision percentage, matrix accuracy percentage, laboratory control sample (LCS) accuracy percentage, method detection limit (MDL), quality limit (QL) and laboratory information management system (LIMS) for various parameters, are included as Appendix C.

4.2 VERIFICATION AND VALIDATION METHODS

Sample collection and field measurement records shall be verified by field technicians and the records shall be kept by the Project Manager(s). Laboratory data shall be verified by the Project Manager. Field and laboratory records shall be archived by each Project Manager.

In the case of data verification resulting in a change to data, the Project Manager shall inform all data users and make corrections.

The Project Manager shall be informed if data accuracy, reliability, or usability has been reduced as the result of errors in stored data or corrupted data files. All data users shall be notified of the problems and corrections made.

4.3 RECONCILIATION WITH USER REQUIREMENTS

The execution of the project shall follow the procedures outlined in this QAPP. Cedarburg personnel and the AM plan administrator are responsible for implementation of the QA/QC measures during each stage of the project.

The QAPP shall be reviewed annually by Cedarburg’s project team. The review shall determine issues to be addressed as the project progresses. Issues to be discussed may include:

- The number and location of sampling stations.
- The frequency of sampling.
- Sampling procedures.
- Parameters measured.
- Data quality objectives and minimum measurement criteria.
- Analytical procedures.
- Project reporting.
- Corrective actions taken.

The QAPP shall be modified, as directed, and approved by the Cedarburg Project Manager, who shall update the QAPP after review and keep a separate record of changes.

APPENDICES

APPENDIX A

Figures:

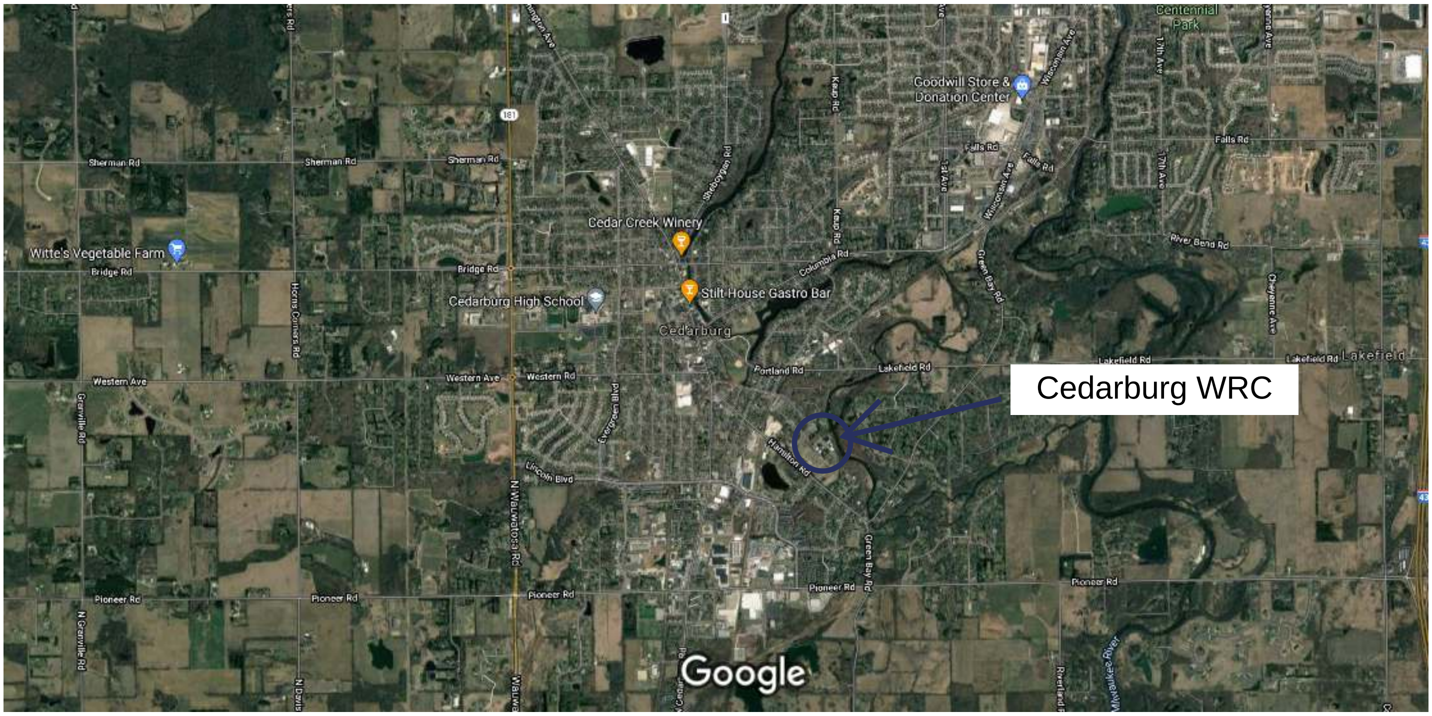
Figure 1 – Site Location

Figure 2 – Creek Monitoring Locations for Adaptive Management

Figure 3 – Permitted Point Sources in the Milwaukee River Basin

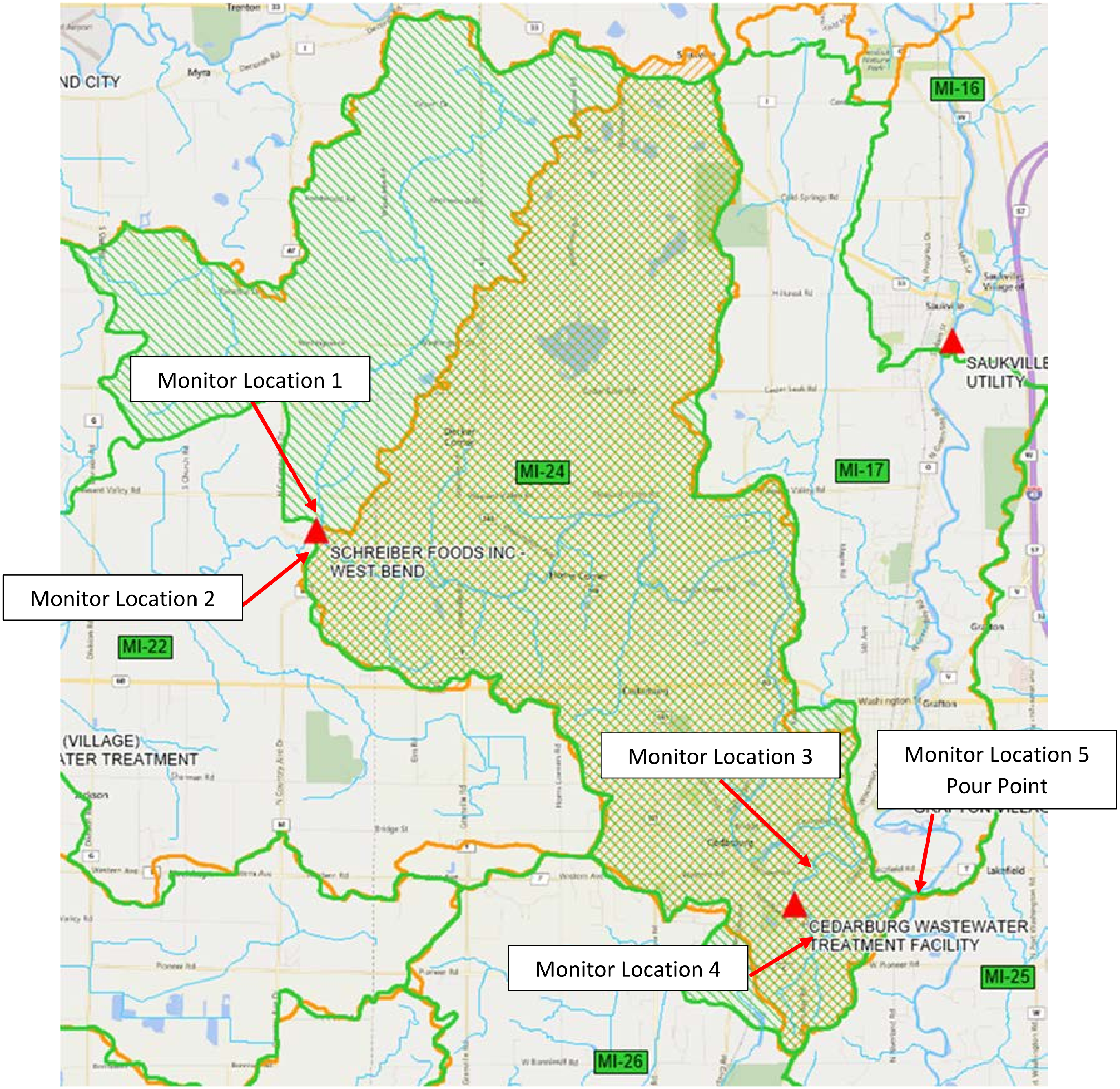
Google Maps

Appendix A1.
Site Location



magery © 1 Landsat / Copernicus, Maxar Technologies, U.S. Geological Survey, USDA Farm Service Agency, Map data © 1 ft

Appendix A2.
Creek Monitoring Locations for Adaptive Management



Permitted Point Sources in the Milwaukee River Basin

APPENDIX B

Tables:

Table 1 – Project Personnel

Table 2 – Sampling Locations

Table 3 – Sample Container, Field Preservation, Holding Time & Detection Limits

TABLE 1.
PROJECT PERSONNEL

Entity	Project Role	Staff
Symbiont	Project Manager	Jonathan R. Butt
	Project Quality Assurance Officer Regulatory Interface	Patrick W. Carnahan
	Sampling and Analysis Plan	Jonathan R. Butt
	Data Analysis Report Preparation	Jonathan R. Butt
Cedarburg	Project Manager	Dennis Grulkowski
	Project Advisor	Eric Hackert
Cedarburg WRC Laboratory	Quality Control	Dennis Grulkowski
	Chemist	Chris Schweda

TABLE 2.
SAMPLING LOCATIONS

Sample Type	Label for Type of Sample	Sample Location No.	Sample Description	Creek Stage	Sampling Frequency	Sample Name
Surface Water		**1**	Determines the total phosphorus concentration of the unnamed creek flowing into Cedar Creek.	Normal flow conditions defined as 25% to 75% of the measured flow through USGS monitoring station 04086500 over the last 30 years.	A minimum of 1 sample collected each month starting in May and extending through October.	**1**
Surface Water		**2**	Determines the total phosphorus concentration of Cedar Creek flowing into the action area.			**2**
Surface Water		**3**	Determines the total phosphorus concentration of Cedar Creek just before flowing into Cedarburg up creek of the WRC outfall			**3**
Surface Water		**4**	Determines the total phosphorus concentration of Cedar Creek just down creek from the WRC outfall.			**4**
Surface Water		**5**	Determines the total phosphorus concentration of Cedar Creek at the out point of the action area			**5**

*Sample locations will be georeferenced using GPS technology.

TABLE 3.
SAMPLE CONTAINER, FIELD PRESERVATION, HOLDING TIME AND DETECTION LIMITS

Parameter	Container and Preservation[1]	Holding Time[2]	Detection Limits/Accuracy
Orthophosphate	Filter, 1L plastic bottle, chill with ice	48 hours, Refrigerate	0.008 mg/L
Total Suspended Solids (TSS)	1L plastic bottle, chill with ice.	7 days, Refrigerate	2.5 mg/L
Total phosphorus	1L plastic bottle, $H_2 SO_4$ to pH<2, chill with ice	28 days, Refrigerate	0.008 mg/L

Notes:

mg/L = milligrams per liter
L = Liter
$H_2 SO_4$ = sulfuric acid
°C = degrees Celsius
+/- = plus and/or minus

[1] All preservatives, if necessary, come in the containers provided by the recommended laboratory.
 * After preservatives, if necessary, are added.

[2] Holding time is defined as from time and date of collection to time and date of analysis.

APPENDIX C

Miscellaneous:

Cedarburg Field Data Sheet
&
Data Summary Sheet

Cedarburg WRC Laboratory Certification
&
Standard Operating Procedures

CEDARBURG FIELD DATA SHEET

PROJECT NAME: Water Quality Monitoring for Cedar Creek

RIVER CONDITIONS: ____________________

PERSON COLLECTING SAMPLES: ____________________ **DATE:** ____________________

SITE CONDITIONS: ____________________

WEATHER CONDITIONS: Sunny Cloudy Overcast Windy Rain Snow

(CIRCLE APPROPRIATE CONDITION)

TEMPERATURE: __________ °F

Quarter ____________________

Site/Sample ID	Sample Time	Depth to Channel Bottom (ft)	Sample Depth (ft)	Temperature (oC)	Flow	DO (mg/L)	Specific Conductivity (uS/cm)	pH (s.u.)	% Saturation	Water Quality Sample	Tubidity	Odor	Algae Present (yes/no)	Color

CEDARBURG DATA SUMMARY SHEET

				Laboratory Parameters	
Sample Location	**Month**	**Sample Date**	**TSS (mg/L)**	**Total Phosphorus (mg/L)**	**Orthophosphate (mg/L)**
1	May				
	June				
	July				
	August				
	September				
	October				
2	May				
	June				
	July				
	August				
	September				
	October				
3	May				
	June				
	July				
	August				
	September				
	October				
4	May				
	June				
	July				
	August				
	September				
	October				
5	May				
	June				
	July				
	August				
	September				
	October				

State of Wisconsin
Department of Natural Resources

recognizes

Wisconsin Registration under NR 149

of

Cedarburg Wastewater Treatment Plant

Laboratory Id: **246002680**

as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (ch. NR149.02 Note) for the parameter(s) specified in the attached Scope of Accreditation.

August 31, 2021
Expiration Date

July 6, 2020
Issued on

Steven Geis, Chief
Environmental Science Services

Preston D. Cole Secretary
Department of Natural Resources

This certificate does not guarantee validity of data generated, but indicates the methodology, equipment, quality control practices, records, and proficiency of the laboratory have been reviewed and found to satisfy the requirements of ch. NR 149, Wis. Adm. Code.

Cedarburg Wastewater Treatment Plant
Revision Date: 11/18/2020
Analyte: Total Phosphorus
Title: HACH Method 10209 TNTplus 843

---

1. **Identification of the test method**
   1.1 Hach Method 10209 Test n Tube plus 843 (4500-P-E 2011)

2. **Applicable analytes**
   2.1 Total Phosphorus

3. **Applicable matrices**
   3.1 Wastewater (Raw Influent and Final Effluent)
   3.2 Drinking water, surface water, and industrial wastes

4. **Method sensitivity**
   4.1 0.01mg/L

5. **Potential interferences**
   5.1 Arsenates react with the molybdate reagent to produce a blue color like that formed with phosphate.
   5.2 Concentrations as low as 0.1mg As/L interfere with the phosphate determination.
   5.3 Hexavalent chromium and NO_2- interfere to give results about 3% low at concentrations of 1mg/L and 10 to 15% low at 10mg/L.
   5.4 Sulfide (Na_2S) and silicate do not interfere at a concentration of 1.0 and 10mg/L (SM 21st edition).

6. **Equipment and analytical instruments**
   6.1 Spectrophotometer (Thermo Scientific Genesys 20)
   6.2 Hach DRB200 Reactor capable of heating to 150 Deg C. (digestion)
   6.3 Test tube racks
   6.4 Hach phosphorus 843 vials
   6.5 Acid-washed 50mL volumetric flasks
   6.6 Acid-washed pipets
   6.7 Auto pipettors with tips

7. Consumable supplies, reagents, and standards

7.1 Sulfuric acid 1.54N

7.2 Sodium Hydroxide solution 1.54N

7.3 Potassium persulfate

7.4 Stock phosphate solution 5ppm

7.5 Second source phosphate working standard 2ppm

7.6 5N Sodium Hydroxide

7.7 Quality Control Check Standards (quarterly blinds)

7.8 Proficiency Test samples

8. Sample preservation, storage and hold time

8.1 We preserve phosphorus samples with sulfuric acid to a pH<2 and keep them in a refrigerator (<6 degrees C. without freezing) until they will be analyzed.

8.2 The hold time for phosphorus samples is 28 days.

9. Quality control samples and frequency of their analysis

9.1 The sample cell used to standardize the instrument is thoroughly rinsed first to ensure that contaminants from the previous test are not present. The outside surfaces of the sample are dried with a Kim-Wipe before placing it into the sample cell, and care is taken to make sure that the cell is placed in the same direction each time. Water droplets in the cell holder light slit, on the photocell window, or on the sample cell will cause error in the instrument reading; therefore, all surfaces must always be kept clean and dry.

9.2 Run blank at the beginning of each run of 20 samples, blank must be <LOD. If not, re-analyze, if still out of range qualify data.

9.3 Calibrate every 3 months or whenever lot numbers change. Analyze ICV standard after calibration from a second source standard. Calibration r-value is required to be > 0.995, if not re-calibrate.

9.4 Run a second source standard after making a new calibration curve (2x/year)

9.5 Run quarterly QCS samples from WSLH

9.6 Run an annual reference sample from WSLH

9.7 Run an LCS/CCV standard on each day of analysis

9.8 New calibrations are recorded on bench sheets and new MDL is forward to clients reports

9.9 Initial Method Detection Limit capability: Demonstrate the ability to generate acceptable data by analysis of the following: 7 replicate samples, record results on MDL worksheet, must meet the 5-point check requirements, if not re-mix standards and re-run.

9.10 Initial Demonstration of Capability Statement before beginning any certified analyses.

10 Calibration and standardization

10.1 We create a new calibration curve every year.

10.2 We also calibrate the spectrophotometer with an instrument blank on each day of analysis.

11 Procedure for analysis

11.1 First, the operator must wash his/her hands and put on lab gloves before beginning analysis to decrease the chances of contamination.

11.2 Turn on the DRB200 reactor in fume hood. Heat to 150°C for the 30-minute setting.

11.3 All preserved samples should be neutralized prior to setting up samples using 5N sodium hydroxide. Pipet 3mL of 5N NaOH into the 500mL samples and 1.5mL into the 250mL samples. Then invert the samples several times to mix them.

11.4 Label all the test vials that you are using today (the ultra-fine tip sharpie works best).

11.5 Carefully remove the foil lids from the DosiCap Zip caps. Remove the caps from the test vials.

11.6 Use a pipettor to dispense 2.0mL of ultra-pure distilled water for the method blank, 1.5mL for the LCS, and 1.6mL for the influent samples.

11.7 Then use the smaller pipettor to add 0.5mL of the 2ppm Phosphorus working standard to the LCS vial, discard that tip, and then use a different tip to dispense 0.4mL of influent sample to your influent vials.

11.8 Now use the bigger pipettor to add 2.0mL of effluent sample to each effluent vial.

11.9 Turn the DosiCaps over the test vials so that the persulfate reagent side goes on the vials. Tighten the caps on the vials.

11.10 Shake the vials several times to dissolve the persulfate reagent in the caps.

11.11 Look through the open end to make sure that the reagent has dissolved.

11.12 Insert the vials into the preheated DRB200 reactor. Close the lid.

11.13 Press the start button and they will now digest for 30 minutes at 150°C.

11.14 When the timer expires, carefully remove the vials from the reactor.

11.15 Set the vials in in the test tube rack and let them cool to room temperature. Or place them in the refrigerator or freezer to accelerate the cooling process.

11.16 Use a pipettor to add 0.2mL (200ul) of Solution B (1.54N Sodium Hydroxide) to the test vials. Immediately tighten cap on the Solution B container when done.

11.17 Put a grey DosiCap C on the vials.

11.18 Tighten the caps on the vials and shake them several times. These grey caps contain the color reagent.

11.19 Start the reaction time of 10 minutes.

11.20 When the timer expires, invert the vials 2-3 times.

11.21 Clean the vials using a Kim Wipe first and then place them one by one into the cell holder in the spectrophotometer (Genesys 20 at 880nm).

11.22 The LCS/CCV must be read before the Method Blank and its absorbance reading placed in the appropriate column on the bench sheet.

11.23 Record the absorbance reading directly to bench sheet on computer or attach scrap paper with raw absorbance data to the bench sheet when printed.

12 Data assessment and acceptance criteria for quality control measures

12.1 The method blank must be below the LOD. If not, the analyst must re-mix and re-analyze the entire batch. No samples can be run until the blank meet's requirements. A corrective action report must also be filed.

12.2 The LCS/CCV standard must be within 90-110% of the theoretical value. If not, the analyst must re-mix and re-analyze until it comes in range. Also fill out a corrective action report.

13 Corrective actions and contingencies for handling out of control or unacceptable data

13.1 If any of the QC measures fail then a corrective action form is filled out and the data are qualified on the DMR.

14 Waste Management

14.1 Waste from the test does not require special consideration. Disposal of waste down the sink followed by a tap water rinse is recommended.

14.2 The Cedarburg WWTP shall do its best to minimize pollution of the environment and manage its hazardous wastes in a safe and environmentally sound manner.

14.3 Consider environmental impact when purchasing materials, handling chemicals and disposing of wastes.

15 References

15.1 Standard Methods for the Examination of Water and Wastewater, 22nd ed. Clesceri, L.S.; Rice et. Al.

15.2 Hach methods manual.

APPENDIX B

Letters Of Support

CEDAR CREEK FARMERS
Improving Land for Cleaner Waters

June 24, 2021

To Whom It May Concern:

Re: City of Cedarburg/Cedar Creek Farmers Partnership

As landowners, farmers and stewards of the land within the Cedar Creek Watershed-Milwaukee River Basin, it is in our best interest to protect the soil and surface water resources where we live and work. We understand that soil health, land conservation and regional water quality of our lakes, rivers, and creeks are linked together and that improving one also benefits the other. The Cedar Creek Farmers-Producer Led Watershed Group will continue its dedication to improving soil health and water quality throughout the watershed while implementing and promoting conservation on the farm.

We are interested in learning more about the City of Cedarburg's Adaptive Management Plan and to explore opportunities to work together on mutual goals. Meetings have begun bringing both sides to the table that will hopefully create a working relationship between the City and local farmers. With that being said, The Cedar Creek Farms support the City of Cedarburg's interest in finding creative ways to meet both the farmers' needs and the City's goal of improving water quality in Cedar Creek.

Thank You,

Cedar Creek Farmers - Producer-Led Watershed Group Board

Ross Bishop
Lee Kissinger
Terry Kohl
Ben Marks
Stan Miller
Brian Peters
Dave Polzin
Paul Puestow
Al Schmidt

OZAUKEE COUNTY

LAND & WATER MANAGEMENT DEPARTMENT

[redacted]

September 1, 2021

To: Wisconsin Department of Natural Resources

FROM: Andy Holschbach, Director
Ozaukee County Land & Water Management Department

RE: Partnering with the City of Cedarburg to Reduce Phosphorus and Improve Water Quality

The Ozaukee County Land & Water Management Department will be glad to assist the City of Cedarburg in their efforts to reduce phosphorus through adaptive management. Our department has had many successes working with the agricultural community to reduce phosphorus and other runoff sources to improve water quality.

We are presently working with the Cedar Creek Farmers and the Milwaukee River Watershed Clean Farm Families, two farmer led groups, focused on improving water quality by improving soil health. Through these efforts more and more farmers each year are planting cover crops and minimizing tillage.

Through the Ozaukee County Soil Health Initiative our department provides a cover crop planting service. The county interseeder planter/no-till drill, a tractor and driver are available at $14/acre to plant cover crops. This service is available to assist farmers in the City of Cedarburg project area.

The county looks forward to collaborating with the City of Cedarburg.

121 W. Main Street, P.O. Box 994, Port Washington, WI 53074
Phone: (262) 284-8270 Metro: (262) 238-8313 Fax: (262) 284-8367 Metro Fax: (262) 238-8367

WASHINGTON COUNTY
EST 1836
WISCONSIN

Planning and Parks Department
Jamie Ludovic, Central Services Director
Debora Sielski, Deputy Director, Planning and Parks
Paul Sebo, Conservation & Zoning Manager

Public Agency Center
333 E. Washington Street, Suite 2300
P.O. Box 2003
West Bend, WI 53095-2003
(262) 335-4445
Fax: (262) 335-6868

June 24, 2021

Jonathan Butt, Project Manager
Symbiont Science, Engineering and Construction, Inc.
6737 W. Washington St., Ste 3440
Milwaukee, WI 53214

Dear Mr. Butt & City of Cedarburg Officials:

Re: City of Cedarburg Partnership; Implementation of Adaptive Management

On behalf of the Washington County Land Resources Division, Planning and Parks Department, I am writing to express our support for the City of Cedarburg's Adaptive Management Program. The Washington County Land Conservation Office has been, and continues to be, a regional leader on phosphorus reduction and total suspended solid runoff into our local rivers, lakes and streams. We look forward to working with the City of Cedarburg as another partner, focused on improving the water quality within the Milwaukee River Basin; more specifically the Cedar Creek Watershed.

Conservation staff have met with the City of Cedarburg/an authorized representative for the City on multiple occasions and have become more familiar with the City's Adaptive Management Plan. We look forward to helping the City of Cedarburg using watershed-based solutions to improve water quality in Cedar Creek. The County is interested in working with the City on promoting and installing best management practices while assisting local farmers with improving soil health and reducing soil/nutrient runoff.

Sincerely,

Paul B. Sebo

Paul B. Sebo
Conservation and Zoning Manager

APPENDIX C

SNAP Plus Output Information

NM2: Application Restriction Compliance Check Report

For Years	**2018 - 2025**
Plan Year	**2021**
Reported For	**CEDARBURG**
Printed	**2021-02-18**
Plan Completion/Update Date	**2021-02-17**
SnapPlus Version 20.3 built on 2021-02-18	
C:\PITA\CEDARBURG.snapDb	

Prepared for:
CEDARBURG
attn:CEDARBURG

This farm uses both PI and Soil Test P for P2O5 590 Compliance

Farm Problems
No spreader calibration rate documentation has been selected.

Rotational Restriction Problems

Field Name	Rotation Years	Problem
SB1	2018-2025	Rotational soil loss of 3.8 exceeds T of 3
SB3	2018-2025	Rotational soil loss of 3.5 exceeds T of 3

Soil Test Problems

Field Name	Soil Test Date	Too Few Soil Samples	Soil Test Too Old
SB1	2021-02-16	**X**	
SB2	2021-02-16	**X**	

Field Name	Soil Test Date	Too Few Soil Samples	Soil Test Too Old
SB3	2021-02-16	X	
SB4	2021-02-16	X	

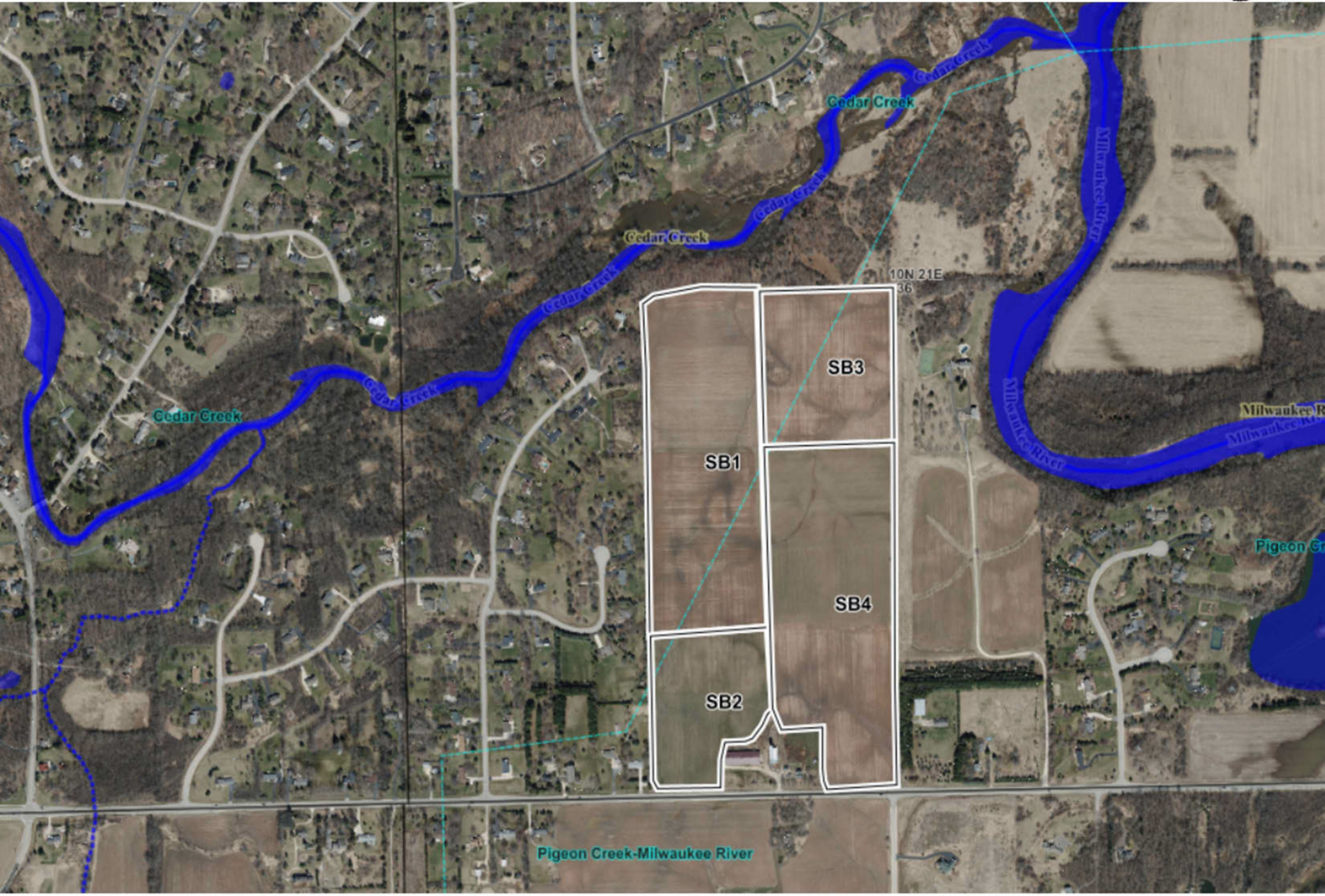
Soil Test Problems Legend	
Too Few Soil Samples	Less than one sample per five acres.
Soil Test Data Too Old	Soil test is greater than 4 years old

Application Restriction Problems

Field Name	Year	Problem	Explanation
SB1	2022	Overapplication of fertilizer N of 12 lbs N/acre.	
SB2	2022	Overapplication of fertilizer N of 12 lbs N/acre.	
SB3	2025	This plan uses purchased fertilizer to apply more P2O5 than is recommended for the crop rotation on this field. The P2O5 soil test interpretation is High for this field. Reduce or eliminate P2O5 fertilizer on this field.	
SB4	2024	Overapplication of fertilizer N of 12 lbs N/acre.	

CEDARBURG

Farm: CEDARBURG, V20 Generated:2/18/2021, Crop year: 2021, Township Range Section:10N 21E s36



NM3: Field Data and 590 Assessment Plan

Reported For	CEDARBURG
Printed	2021-02-18
Plan Completion/Update Date	2021-02-17
SnapPlus Version 20.3 built on 2021-02-18	
C:\PITA\CEDARBURG.snapDb	

Prepared for:
CEDARBURG
attn:CEDARBURG

Field Data: 75 Total Acres Reported.

Field Name	SubFarm	FSA Trct	FSA Fld	Acres	County	Critical Soil Series & Symbol	F. Slp %	F.Slp Len ft	Below Field Slope To Water %	Dist.To Water ft	Contour/ Filters	Irrig	Tiled	Rotation	Tillage	Report Period	Field "T" t/ac	Rot Avg Soil Loss t/ac	SCI	Rot Avg PI	Soil Test P ppm	Rot P2O5 Bal lb/ac	P2O5 Bal Target lb/ac
SB1				25.4	Ozaukee	KEWAUNEE KoC2	10	100	0 - 2	0 - 300	No / No	No	Yes	Cg-Sg15-Cg-Sg15-Wwg+s-Cg-As-A	FFC-FVT-SVT-NT-NT-SVT-FCND-None	2018-2025	**3**	**3.8**	**0.5**	**4**	30	-284	-
SB2				10.3	Ozaukee	KEWAUNEE KoC2	6	150	0 - 2	1001 - 5000	No / No	No	Yes	A-Afk-Cg-Sg15-Wwg+s-Cg-As-A	None-None-FCND-FCND-NT-SVT-FCND-None	2018-2025	**3**	**2.3**	**0.6**	**3**	30	-319	-
SB3				13.2	Ozaukee	KEWAUNEE KoC2	8	120	0 - 2	301 - 1000	No / No	No	Yes	Cg-Sg15-Cg-Sg15-As-A-A-A	FCND-FVT-FCND-NT-FCND-None-None-None	2018-2025	**3**	**3.5**	**0.4**	**4**	30	-232	-
SB4				25.7	Ozaukee	KEWAUNEE KoC2	8	120	2.1 - 6	301 - 1000	No / No	No	Yes	A-A-A-Afk-Cg-Sg15-Wwg+s-Cg	None-None-None-None-SVT-NT-NT-FCND	2018-2025	**3**	**2.5**	**0.6**	**3**	30	-360	-

Crop Abbreviations	
Abbreviation	**Crop**
A	Alfalfa
Afk	Alfalfa, fall killed
As	Alfalfa Seeding Spring
Cg	Corn grain
Sg15	Soybeans 15-20 inch row
Wwg+s	Winter wheat (grain+straw)

Tillage Abbreviations	
Abbreviation	**Tillage**
FCND	Fall Chisel, no disk
FFC	Fall Cultivation
FVT	Fall vertical tillage
None	None
NT	No Till
SVT	Spring vertical tillage

FM6: Soil Test Report

Reported For	CEDARBURG
Printed	**2021-02-18**
Plan Completion/Update Date	**2021-02-17**
SnapPlus Version 20.3 built on 2021-02-18	
C:\PITA\CEDARBURG.snapDb	

Prepared for:
CEDARBURG
attn:CEDARBURG

			Predominant					Samples				in ppm			
Field Name	**Subfarm**	**Acres**	**Soil Map Symbol**	**Soil Name**	**Soil Test Date**	**Soil Test Lab**	**Lab Number**	**Rec. #**	**Actual #**	**pH**	**OM%**	**P**	**K**	**S**	**CEC**
SB1		25.4	KnB	KEWAUNEE	2021-02-17	ASSUMED	LOW	**5**	**1**	7.5	3.0	15	100	0	0
SB1		25.4	KnB	KEWAUNEE	2021-02-16	ASSUMED	MED	**5**	**1**	7.5	3.0	30	110	0	0
SB1		25.4	KnB	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**5**	**1**	7.5	3.0	60	120	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-17	ASSUMED	LOW	**2**	**1**	7.5	3.0	15	100	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-16	ASSUMED	MED	**2**	**1**	7.5	3.0	30	110	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**2**	**1**	7.5	3.0	60	120	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-17	ASSUMED	LOW	**3**	**1**	7.5	3.0	15	100	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-16	ASSUMED	MED	**3**	**1**	7.5	3.0	30	110	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**3**	**1**	7.5	3.0	60	120	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-17	ASSUMED	LOW	**5**	**1**	7.5	3.0	15	100	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-16	ASSUMED	MED	**5**	**1**	7.5	3.0	30	110	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**5**	**1**	7.5	3.0	60	120	0	0

Crop Year Soil Test Needed

Field Name	Soil Test Date	2021	2022	2023	2024	2025
SB1	2021-02-17					X
SB2	2021-02-17					X
SB3	2021-02-17					X

Field Name	Soil Test Date	2021	2022	2023	2024	2025
SB4	2021-02-17					X

SL2: Annual Soil Loss Report

Reported For	CEDARBURG
Printed	2021-02-18
Plan Completion/Update Date	2021-02-17
SnapPlus Version 20.3 built on 2021-02-18	
C:\PITA\CEDARBURG.snapDb	

Prepared for:
CEDARBURG
attn:CEDARBURG

									Annual Soil Loss (t/ac)							
Field	Soil Series & Symbol (critical)	Slope	Slope Len	Contour/ Filters	Rotation	Tillage	Field "T" t/ac/yr	Rot Avg Soil Loss t/ac/yr	2018	2019	2020	2021	2022	2023	2024	2025
SB1	KEWAUNEE KoC2	10	100	No / No	Cg-Sg15-Cg-Sg15-Wwg+s-Cg-As-A	FFC-FVT-SVT-NT-NT-SVT-FCND-None	3	3.8	5.4	2.8	5.6	2.8	3.7	6.1	2.2	2.2
SB2	KEWAUNEE KoC2	6	150	No / No	A-Afk-Cg-Sg15-Wwg+s-Cg-As-A	None-None-FCND-FCND-NT-SVT-FCND-None	3	2.3	1.2	0.8	4.7	2.2	3.0	4.0	1.4	1.4
SB3	KEWAUNEE KoC2	8	120	No / No	Cg-Sg15-Cg-Sg15-As-A-A-A	FCND-FVT-FCND-NT-FCND-None-None-None	3	3.5	5.7	2.4	7.2	2.5	5.1	2.2	1.6	1.1
SB4	KEWAUNEE KoC2	8	120	No / No	A-A-A-Afk-Cg-Sg15-Wwg+s-Cg	None-None-None-None-SVT-NT-NT-FCND	3	2.5	1.2	1.0	0.8	0.5	4.1	2.2	2.8	7.6

* This column shows estimated sediment delivery through a **designed** field edge grass filter area when that field management option is selected.

Crop Abbreviations	
Abbreviation	**Crop**
A	Alfalfa
Afk	Alfalfa, fall killed

Tillage Abbreviations	
Abbreviation	**Tillage**
FCND	Fall Chisel, no disk
FFC	Fall Cultivation

As	Alfalfa Seeding Spring
Cg	Corn grain
Sg15	Soybeans 15-20 inch row
Wwg+s	Winter wheat (grain+straw)

FVT	Fall vertical tillage
None	None
NT	No Till
SVT	Spring vertical tillage

FM10: Annual PI Report

Reported For	CEDARBURG
Printed	**2021-02-18**
Plan Completion/Update Date	**2021-02-17**
SnapPlus Version 20.3 built on 2021-02-18	
C:\PITA\CEDARBURG.snapDb	

Prepared for:
CEDARBURG
attn:CEDARBURG

Field Name	Soil Series & Symbol (critical)	Slope	Tillage	Rot Avg PI	PI	2018	2019	2020	2021	2022	2023	2024	2025
SB1	KEWAUNE E KoC2	10	FFC-FVT-SVT-NT-NT-SVT-FCND-None	**4**	Total Particulate Soluble	5.3 4.9 0.4	2.8 2.5 0.3	5.3 5.0 0.3	3.6 3.0 0.6	5.3 4.7 0.6	6.2 5.8 0.4	2.9 2.6 0.2	3.8 3.3 0.5
SB2	KEWAUNE E KoC2	6	None-None-FCND-FCND-NT-SVT-FCND-None	**3**	Total Particulate Soluble	1.4 1.1 0.3	1.0 0.7 0.3	3.8 3.7 0.2	2.3 2.1 0.2	4.2 3.8 0.4	3.7 3.4 0.4	1.7 1.5 0.2	2.4 1.9 0.4
SB3	KEWAUNE E KoC2	8	FCND-FVT-FCND-NT-FCND-None-None-None	**4**	Total Particulate Soluble	5.1 4.9 0.3	2.3 2.0 0.3	6.4 6.2 0.2	3.2 2.6 0.6	6.5 6.2 0.3	4.0 3.4 0.6	3.0 2.3 0.6	2.0 1.4 0.6
SB4	KEWAUNE E KoC2	8	None-None-None-None-SVT-NT-NT-FCND	**3**	Total Particulate Soluble	1.4 1.0 0.3	1.2 0.9 0.3	1.0 0.7 0.2	1.1 0.7 0.5	4.0 3.7 0.3	2.7 2.2 0.4	3.9 3.5 0.5	7.3 7.1 0.2

NM2: Application Restriction Compliance Check Report

For Years	**2018 - 2025**
Plan Year	**2021**
Reported For	**CEDARBURG CRP**
Printed	**2021-02-18**
Plan Completion/Update Date	**2021-02-18**
SnapPlus Version 20.2 built on 2021-02-10	
C:\PITA\CEDARBURG CRP.snapDb	

Prepared for:
CEDARBURG CRP
attn:CEDARBURG CRP

Prepared by:

This farm uses both PI and Soil Test P for P2O5 590 Compliance

Farm Problems
No spreader calibration rate documentation has been selected.

Rotational Restriction Problems

No Rotational Problems found

Soil Test Problems

No Soil Test Problems

Soil Test Problems Legend	
Too Few Soil Samples	Less than one sample per five acres.
Soil Test Data Too Old	Soil test is greater than 4 years old

Application Restriction Problems

No Application Restriction Problems found

FM6: Soil Test Report

Reported For	CEDARBURG CRP
Printed	2021-02-18
Plan Completion/Update Date	2021-02-18
SnapPlus Version 20.2 built on 2021-02-10	
C:\PITA\CEDARBURG CRP.snapDb	

Prepared for:
CEDARBURG CRP
attn:CEDARBURG CRP

Prepared by:

			Predominant					Samples				in ppm			
Field Name	Subfarm	Acres	Soil Map Symbol	Soil Name	Soil Test Date	Soil Test Lab	Lab Number	Rec. #	Actual #	pH	OM%	P	K	S	CEC
SB1		25.4	KnB	KEWAUNEE	2021-02-17	ASSUMED	LOW	**5**	**1**	7.5	3.0	15	100	0	0
SB1		25.4	KnB	KEWAUNEE	2021-02-16	ASSUMED	MED	**5**	**1**	7.5	3.0	30	110	0	0
SB1		25.4	KnB	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**5**	**1**	7.5	3.0	60	120	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-17	ASSUMED	LOW	**2**	**1**	7.5	3.0	15	100	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-16	ASSUMED	MED	**2**	**1**	7.5	3.0	30	110	0	0
SB2		10.3	KnB	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**2**	**1**	7.5	3.0	60	120	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-17	ASSUMED	LOW	**3**	**1**	7.5	3.0	15	100	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-16	ASSUMED	MED	**3**	**1**	7.5	3.0	30	110	0	0
SB3		13.2	KoB2	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**3**	**1**	7.5	3.0	60	120	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-17	ASSUMED	LOW	**5**	**1**	7.5	3.0	15	100	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-16	ASSUMED	MED	**5**	**1**	7.5	3.0	30	110	0	0
SB4		25.7	KoC2	KEWAUNEE	2021-02-15	ASSUMED	HIGH	**5**	**1**	7.5	3.0	60	120	0	0

Crop Year Soil Test Needed

Field Name	Soil Test Date	2021	2022	2023	2024	2025
SB1	2021-02-17					X
SB2	2021-02-17					X
SB3	2021-02-17					X

Field Name	Soil Test Date	2021	2022	2023	2024	2025
SB4	2021-02-17					X

SL2: Annual Soil Loss Report

Reported For	**CEDARBURG CRP**
Printed	**2021-02-18**
Plan Completion/Update Date	**2021-02-18**
SnapPlus Version 20.2 built on 2021-02-10	
C:\PITA\CEDARBURG CRP.snapDb	

Prepared for:
CEDARBURG CRP
attn:CEDARBURG CRP

Prepared by:

									Annual Soil Loss (t/ac) Surface Residue							
Field	**Soil Series & Symbol (critical)**	**Slope**	**Slope Len**	**Contour/ Filters**	**Rotation**	**Tillage**	**Field "T" t/ac/yr**	**Rot Avg Soil Loss t/ac/yr**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**
SB1	KEWAUNEE KoC2	10	100	No / No	Cg-Sg15-Cg-GHs-CRP-CRP-CRP-CRP	FFC-FVT-SVT-FCND-None-None-None-None	3	1.3	1.0	2.1	5.1	1.9	0.2	0.1	0.1	0.0
									74%	69%	47%	50%	87%	82%	81%	81%
SB2	KEWAUNEE KoC2	6	150	No / No	A-Afk-Cg-GHs-CRP-CRP-CRP-CRP	None-None-FCND-FCND-None-None-None-None	3	0.7	0.1	0.2	3.8	1.3	0.1	0.1	0.0	0.0
									67%	48%	15%	47%	87%	82%	81%	81%
SB3	KEWAUNEE KoC2	8	120	No / No	Cg-Sg15-Cg-GHs-CRP-CRP-CRP-CRP	FCND-FVT-FCND-FCND-None-None-None-None	3	1.5	1.4	1.9	6.8	1.9	0.1	0.1	0.0	0.0
									30%	68%	15%	47%	87%	82%	81%	81%
SB4	KEWAUNEE KoC2	8	120	No / No	A-A-A-GHs-CRP-CRP-CRP-CRP	None-None-None-FCND-None-None-None-None	3	0.6	0.1	0.2	0.2	4.0	0.1	0.1	0.0	0.0
									67%	48%	44%	14%	85%	82%	81%	81%

* This column shows estimated sediment delivery through a **designed** field edge grass filter area when that field management option is selected.

Crop Abbreviations

Abbreviation	Crop
A	Alfalfa
Afk	Alfalfa, fall killed
Cg	Corn grain
CRP	CRP
GHs	Grass hay Seeding
Sg15	Soybeans 15-20 inch row

Tillage Abbreviations

Abbreviation	Tillage
FCND	Fall Chisel, no disk
FFC	Fall Cultivation
FVT	Fall vertical tillage
None	None
SVT	Spring vertical tillage

FM10: Annual PI Report

Reported For	CEDARBURG CRP
Printed	2021-02-18
Plan Completion/Update Date	2021-02-18
SnapPlus Version 20.2 built on 2021-02-10	
C:\PITA\CEDARBURG CRP.snapDb	

Prepared for:
CEDARBURG CRP
attn:CEDARBURG CRP

Prepared by:

Field Name	Soil Series & Symbol (critical)	Slope	Tillage	Rot Avg PI	PI	2018	2019	2020	2021	2022	2023	2024	2025
SB1	KEWAUNE E KoC2	10	FFC-FVT-SVT-FCND-None-None-None-None	**1**	Total Particulate Soluble	1.2 0.9 0.3	2.1 1.8 0.3	4.8 4.5 0.3	1.8 1.7 0.1	0.3 0.1 0.2	0.3 0.1 0.2	0.2 0.0 0.1	0.2 0.0 0.1
SB2	KEWAUNE E KoC2	6	None-None-FCND-FCND-None-None-None-None	**1**	Total Particulate Soluble	0.3 0.1 0.2	0.3 0.1 0.2	3.1 2.9 0.1	1.1 1.0 0.1	0.2 0.1 0.1	0.2 0.1 0.1	0.1 0.0 0.1	0.1 0.0 0.1
SB3	KEWAUNE E KoC2	8	FCND-FVT-FCND-FCND-None-None-None-None	**2**	Total Particulate Soluble	1.4 1.2 0.2	1.9 1.6 0.2	6.0 5.8 0.2	1.7 1.6 0.1	0.3 0.1 0.2	0.2 0.1 0.2	0.2 0.0 0.1	0.2 0.0 0.1
SB4	KEWAUNE E KoC2	8	None-None-None-FCND-None-None-None-None	**1**	Total Particulate Soluble	0.3 0.1 0.2	0.4 0.2 0.2	0.4 0.2 0.2	3.5 3.4 0.1	0.2 0.1 0.1	0.2 0.1 0.1	0.2 0.0 0.1	0.1 0.0 0.1

NM1: Narrative and Crops Report

Starting Year	**2021**
Reported For	**Cedarburg default managment Subfarm: 7-27-21 CC EXAMPLES**
Printed	**2021-07-27**
Plan Completion/Update Date:	**2021-02-17**
SnapPlus Version 20.4 built on 2021-06-03	
C:\PITA\CEDARBURG default.snapDb	

Prepared for:
Cedarburg default managment
attn:CEDARBURG

Prepared by: InDepth Agronomy
8426 Borgwardt Lane
Manitowoc,Manitowoc,54220
920-758-2988,920-758-2987
steve.hoffman@indepthagronomy.com

SubFarm has 2 fields totalling 37.2 cropped acres.
Farm Narrative: 7-27-21 This NMP was written to compare the effect of default soil and crop managment on the Wisconsin Phosphorus Index.

Annual Farm Notes:

No Annual Farm Notes

Spreader Calibration Methods: No spreader calibration rate documentation has been selected.

Narrative and Crops:

Field Name	Field Acres	2021	2022	2023	2024	2025	2026
CC East	12.8	Soybeans 15-20 inch row Fall Chisel, no disk 56-65 bu/acre	Winter wheat (grain +straw) No Till 81-100 bu/acre	Corn grain No Till 191-210 bu/acre	Soybeans 15-20 inch row No Till 56-65 bu/acre	Winter wheat (grain +straw) No Till 81-100 bu/acre	Corn grain No Till 191-210 bu/acre
CC West	23.2	Soybeans 15-20 inch row Fall Chisel, disked 56-65 bu/acre	Winter wheat (grain +straw) Fall vertical tillage 81-100 bu/acre	Corn grain Fall Chisel, no disk 191-210 bu/acre	Soybeans 15-20 inch row Fall Chisel, disked 56-65 bu/acre	Winter wheat (grain +straw) Fall vertical tillage 101-120 bu/acre	Corn grain Fall Chisel, disked 191-210 bu/acre

Summary by Crop:
NOTE: Yields calculated using the midpoint of the SnapPlus yield goal range for each crop.

Crops Grouped By Category		2021	2022	2023	2024	2025	2026
Corn grain	Acres bu			36 7,218			36 7,218
Soybeans 15-20 inch row	Acres bu	36 2,178			36 2,178		
Winter wheat (grain +straw)	Acres bu		36 3,258			36 3,258	

FM10: Annual PI Report

Reported For	Cedarburg default managment Subfarm: 7-27-21 CC EXAMPLES
Printed	2021-07-27
Plan Completion/Update Date	2021-02-17
SnapPlus Version 20.4 built on 2021-06-03	
C:\PITA\CEDARBURG default.snapDb	

Prepared for:
Cedarburg default managment
attn:CEDARBURG

Prepared by: InDepth Agronomy
8426 Borgwardt Lane
Manitowoc,Manitowoc,54220
920-758-2988,920-758-2987
steve.hoffman@indepthagronomy.com

Field Name	Soil Series & Symbol (critical)	Slope	Tillage	Rot Avg PI	PI	2019	2020	2021	2022	2023	2024	2025	2026
CC East	CASCO HsD2	12	NT-NT-FCND-NT-NT-NT-NT-NT	**2**	Total Particulate Soluble	0.7 0.6 0.1	1.4 1.2 0.1	0.9 0.8 0.0	3.4 3.2 0.1	3.6 3.4 0.2	0.8 0.7 0.1	1.3 1.2 0.1	1.9 1.8 0.1
CC West	FOX FmB	4	FVT-FCND-FCD-FVT-FCND-FCD-FVT-FCD	**2**	Total Particulate Soluble	1.0 0.7 0.3	2.4 2.1 0.2	0.9 0.8 0.1	1.8 1.5 0.3	2.7 2.4 0.3	0.8 0.7 0.1	1.5 1.2 0.3	2.5 2.3 0.2

FM10: Annual PI Report

Prepared by: InDepth Agronomy
8426 Borgwardt Lane
Manitowoc,Manitowoc,54220
920-758-2988,920-758-2987
steve.hoffman@indepthagronomy.com

Field Name	Soil Series & Symbol (critical)	Slope	Tillage	Rot Avg PI	PI	2019	2020	2021	2022	2023	2024	2025	2026
CC East	CASCO HsD2	12	NT/NTcvr-NT-NT-NT/NTcvr-NT-NT-NT/NTcvr-NT	**1**	Total Particulate Soluble	1.0 0.9 0.1	1.4 1.3 0.1	0.6 0.5 0.1	1.2 1.1 0.1	1.4 1.3 0.1	0.6 0.5 0.1	1.1 1.0 0.1	1.4 1.3 0.1
CC West	FOX FmB	4	NT/NTcvr-NT-NT-NT/NTcvr-NT-NT-NT/NTcvr-NT	**1**	Total Particulate Soluble	0.9 0.5 0.3	0.9 0.6 0.3	0.6 0.3 0.3	0.9 0.6 0.3	0.9 0.6 0.3	0.5 0.3 0.3	0.8 0.6 0.2	0.8 0.5 0.3

APPENDIX D

USGS Flow Data for Cedar Creek

Click to hideNews Bulletins

- Explore the *NEW* USGS National Water Dashboard interactive map to access real-time water data from over 13,500 stations nationwide.
- Full News

USGS Surface-Water Annual Statistics for Wisconsin

Click to hide state-specific text

During the winter, river stage may be significantly affected by backwater from ice, resulting in incorrect discharge data. Consequently, discharge data may not be displayed during periods of ice effect.

The statistics generated from this site are based on approved daily-mean data and may not match those published by the USGS in official publications. The user is responsible for assessment and use of statistics from this site. For more details on why the statistics may not match, click here.

USGS 04086500 CEDAR CREEK NEAR CEDARBURG, WI

Available data for this site Time-series: Annual statistics GO

	Output formats
Ozaukee County, Wisconsin Hydrologic Unit Code 04040003 Latitude 43°19'23", Longitude 87°58'43" NAD83 Drainage area 120 square miles Gage datum 795.15 feet above NAVD88	HTML table of all data Tab-separated data Reselect output format

Water Year	00060, Discharge, cubic feet per second
1931	18.8
1932	57.2
1933	67.9
1934	13.5
1935	65
1936	31

Water Year	00060, Discharge, cubic feet per second
1937	78.1
1938	96.4
1939	56.9
1940	62
1941	46.8
1942	63.6
1943	92
1944	36.3
1945	33.7
1946	83.6
1947	49.4
1948	65.5
1949	36.5
1950	70.2
1951	80.3
1952	159.4
1953	75.9
1954	47.3
1955	112.7
1956	43.8
1957	35.1
1958	20.2
1959	60.5
1960	121.7
1961	67.1
1962	74.9
1963	30.6
1964	36.1
1965	90.7
1966	94.4
1967	45.6
1968	38.7
1969	55.7
1970	32.1

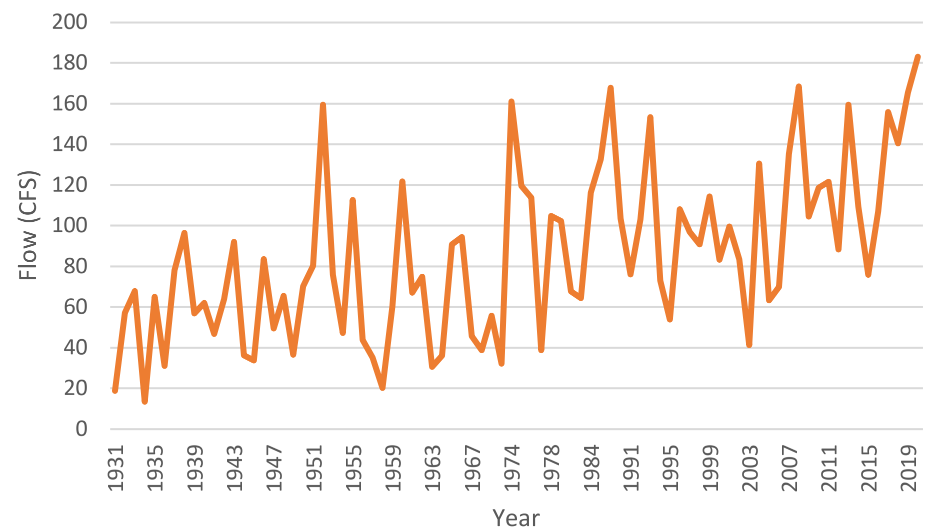
Water Year	00060, Discharge, cubic feet per second
1974	161
1975	119.6
1976	113.7
1977	38.7
1978	104.8
1979	102.2
1980	67.7
1981	64.4
1984	116.2
1985	132.6
1986	167.8
1987	103.5
1991	76
1992	103
1993	153.3
1994	73
1995	53.8
1996	108.1
1997	96.9
1998	90.7
1999	114.3
2000	83.3
2001	99.6
2002	83.4
2003	41.2
2004	130.6
2005	63.3
2006	69.9
2007	135.3
2008	168.4
2009	104.5
2010	118.6
2011	121.6
2012	88.3

Water Year	00060, Discharge, cubic feet per second
2013	159.4
2014	109.3
2015	75.9
2016	107
2017	155.8
2018	140.5
2019	165.5
2020	183.1
** No Incomplete data have been used for statistical calculation	

Average of Annual Means from 1931 to 2020:	85.5	cfs
Average of Annual Means from 1991 to 2020:	109.1	cfs

Year	Annual Mean (CFS)
1931	18.8
1932	57.2
1933	67.9
1934	13.5
1935	65
1936	31
1937	78.1
1938	96.4
1939	56.9
1940	62
1941	46.8
1942	63.9
1943	92
1944	36.3
1945	33.7
1946	83.6
1947	49.4
1948	65.5
1949	36.5
1950	70.2
1951	80.3
1952	159.4
1953	75.9
1954	47.3
1955	112.7
1956	43.8
1957	35.1
1958	20.2

Figure 1: Annual Mean Flow



1959	60.5
1960	121.7
1961	67.1
1962	74.9
1963	30.6
1964	36.1
1965	90.7
1966	94.4
1967	45.6
1968	38.7
1969	55.7
1970	32.1
1974	161
1975	119.6
1976	113.7
1977	38.7
1978	104.8
1979	102.2
1980	67.7
1981	64.4
1984	116.2
1985	132.6
1986	167.8
1987	103.5
1991	76
1992	103
1993	153.3
1994	73
1995	53.8
1996	108.1
1997	96.9
1998	90.7
1999	114.3
2000	83.3

2001	99.6
2002	83.4
2003	41.2
2004	130.6
2005	63.3
2006	69.9
2007	135.3
2008	168.4
2009	104.5
2010	118.6
2011	121.6
2012	88.3
2013	159.4
2014	109.3
2015	75.9
2016	107
2017	155.8
2018	140.5
2019	165.5
2020	183.1